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STUDIES ON THE PERMEABILITY OF LIVING AND DEAD CELLS.

I. NEW QUANTITATIVE OBSERVATIONS ON THE PENETRATION OF ACIDS INTO LIVING AND DEAD CELLS.

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The effect of acids upon the permeability of tissues has attracted the interest of investigators for many years. From the qualitative determinations of such men as Pfeffer (1) and Ruhland (2) were born the efforts of later investigators, who have attempted to place the study of acid penetration upon a quantitative basis. The excellent work of these men has opened the way for further observations.

The first to use quantitative methods was Harvey (3), who made direct observations upon the pigmented gonidial filaments of a holothurian, *Stichopus ananas*, the "prickly fish." This animal contains a pigment which is sensitive to changes in H-ion concentrations within a certain range. Harvey placed animals in equal molecular concentrations (0.01N) of a large number of acids, and measured the time required to produce color change in the pigment. He concluded that there was no relation between degree of dissociation of an acid and its toxicity, but that there is a general relation, though not exact and quantitative, between penetrating power on the one hand and lipid solubility and capillary activity on the other hand.

Crozier (4), noting that Harvey studied only one concentration of acid, made observations at a number of concentrations in a series of acids similar to the concentration employed by Harvey. Although using a totally unrelated animal, he nevertheless obtained results concordant with those obtained by Harvey using 0.01N solutions. Crozier (5) used the mantle tissue of a nudibranch mollusk, *Chromodoris zebra*, which also contains a natural pigment sensitive to acids and changing from blue to pink at a pH of about 5.6. In further studies Crozier (6) found that in most of the lower concentrations butyric acid penetrates more readily than acetic acid, and that the effect of

the relative H-ion concentration on the speed of penetration increases with increasing concentration of acid. In this investigation the same writer made observations on the chloroacetic acids, and from the consistent behavior of the members of this series he was led to conclude that ionization determines the relative penetrating ability. He concludes that the actual speed of penetration through the tissues observed with any acid is dependent upon two influences: namely, preliminary chemical combination with the outer protoplasm followed by diffusion.

Osterhout (7) has shown that the resistance of the marine alga, *Laminaria agardhii*, when it is immersed in different concentrations of HCl, is that which would be expected if this tissue behaved like the mantle tissue of *Chromodoris*.

Haas (8) used acids in such concentrations as to give the same external pH (2.0), and found that acetic acid penetrates into various plant cells more quickly than HCl at the same pH.

Recent work by Loeb (9) has shown that the rate of diffusion of acids into the egg of the marine teleost fish, *Fundulus*, is greatly influenced by the cations present in the surrounding solution.

In this paper the penetration of acids into a living cell has been studied under conditions in which the surrounding solution always consisted of sea water to which had been added traces of acid. The same cations were therefore always present in the same proportions.

Furthermore, the same concentration of hydrogen ions was maintained throughout the whole series of experiments. The recent researches of Loeb (10) on the chemical and physical behavior of proteins have demonstrated the importance of maintaining equal H-ion concentrations when the behavior of ampholytes is involved, and have led the writer to maintain equal external H-ion concentrations throughout the present investigations of the penetrating power of a series of acids. These acids were used in such concentrations as to give a pH of 3.6, because the observations of Loeb show that near this pH the salts of many native proteins have their maximum osmotic pressure, viscosity, and swelling. At this pH adventitious changes in the reaction have relatively little influence on these physical properties, thus minimizing the possible error produced by such changes. At lower H-ion concentrations, such as pH 5.0, it was also found that the time elapsing before there was an appreciable change in the pH of the cell sap was very great, particularly in the case of sulphuric and the weak acids, and the results could not be depended upon for accuracy.

The marine alga, *Valonia ventricosa* (J. Agardh¹) was used because of its exceptional suitability for studying the penetration of sub-

¹ Dr. M. A. Howe, of the New York Botanical Garden, so identified the species used. (Personal communication.)

stances through living protoplasm. It is a single coenocytic cell with a large vacuole which contains cell sap in quantities sufficient for making accurate analyses. Outside of this vacuole is a delicate layer of protoplasm containing many nuclei, chloroplasts, etc., and this in turn is inclosed in a thin, very tough external wall. The size of this organism varies from very small plants to those containing 25 to 50 c. c. of sap. Thus by noting the H-ion concentration of the sap at various intervals after immersing the cell in an acid solution, one can readily detect the entrance of the acid in question.

Valonia ventricosa was obtained by dredging about 3 meters below low tide level along the Florida Keys. The plants usually had adhering to them pieces of coral, sand, sponges, other seaweeds, or débris, and these were all carefully removed before the plants were used for experiments. The plants were collected three times a week. After collection there were always some which were injured, and these cytolyzed usually by the next morning, so that the plants were seldom used immediately after collection. In this way most of the plants not in good condition were eliminated. The ones in good condition were used one day and sometimes two days after collection.

For testing the sap, each cell was thoroughly wiped on filter paper until dry, a small hole punctured through the wall by means of a pointed glass rod, and the sap forced through the opening. As the sap is under considerable pressure it comes out readily. In all of these investigations, hard glass test tubes and tubing were used. The pH determinations were made by means of indicators. Under no conditions was the sap allowed to spray through the air, because CO_2^1 is quickly dissipated, thereby causing a change in the pH of the sap and giving rise to erroneous data. Distilled water was not used for rinsing because of the pronounced influence exerted by it on the hydrostatic pressure within the cell. It was found that when cells were left in distilled water for 10 minutes or even less, they ruptured. It was also found that by wiping a cell thoroughly on filter paper, all particles which might contaminate the sap were effectively removed. It was very important to make certain of this, because the sap at certain H-ion concentrations was almost devoid of buffer properties, and traces of alkali or acid would seriously affect the results.

It was found that the pH of the sap of healthy plants was almost invariably between 6.2 and 6.4 when the free CO_2 was not removed, and between 6.6 and 6.8 when the free CO_2 had been eliminated. One would expect the pH of the CO_2 -free sap of *Valonia ventricosa* to be very close to 7.0, according to the analysis of the sap of *V. macrophysa* (12), most of the salts of which are in the form of chlorides.

¹ This was also noted by Crozier (11).

Crozier (11) found the sap of *V. macrophysa* to have an average pH value of 6.9. This measurement was evidently made without eliminating the CO_2 , as no mention is made of removing it. The slight differences between the results obtained by Crozier and the writer may be due to difference in species or to local conditions. It may be of interest to add that the cell reaction of most plants has been found to be acid. The writer (13) has also had occasion to note the reaction of the sap of a fresh-water alga, *Nitella* sp., which grows at Woods Hole, and found it to have a pH value of 5.7. No account was taken of the CO_2 content of this alga, except the usual care in preventing its escape. In the light of these experiments it would be of interest to find out the pH of the sap of *Nitella* after removing the CO_2 . Some of the larger cells of *Valonia* were more alkaline (pH 7.0 to 7.6). This may be due to the fact that as the cells age they become more permeable to the salts of sea water, and therefore the composition of their sap more nearly approaches that of sea water, the pH of which is 8.6. Only occasionally are small plants found the cell sap of which has a pH of 7.0 and more. These have perhaps been injured at some time. The readings obtained from these were always discarded. Some plants are also incrustated with a growth of some kind of sea weed, which can not be scraped off without injuring the plant. It was found that the readings in which these plants were used could not be relied upon to give accurate results, and they were therefore never used.

Dead cells have the same reaction as sea water, which, in this locality, is pH 8.6. In all of the experiments only those cells which were obviously healthy or in good condition were used. These were dark olive green in color, glossy and very firm and hard. As the plants die they become light green in color and finally soft and dull. The protoplasm then disintegrates and leaves the cells transparent, and the small particles of the disorganized protoplasm can be seen as small dark green or black bits floating loosely in the sap. Not all plants become soft immediately. Some retain their turgor for a long time.

The temperature at which these experiments were done was 24°C . This is the temperature of the sea water at Miami and of the running sea water at the laboratory. It remains constant throughout the year.

It was found that *Valonia* is very sensitive to any slight changes in osmotic pressure, and care was therefore necessary to interfere with this as little as possible. The acids were added to sea water in traces until pH 3.6 was obtained. They were kept constant at this pH by addition of traces or by replacing the liquid, depending on the rapidity with which the pH changed from 3.6.

In all of this work two sets of readings were made; one set, including all the free CO_2 found in the sap and the other set when the free CO_2 had been removed. In all the figures the curves marked "A" indicate the pH of the sap when CO_2 was included in the readings, or, in other words, just as it was inside the cell. Those curves marked "B" indicate the pH of the sap after the CO_2 had been expelled. The CO_2 was blown out by placing the sap in Pyrex tubes and bubbling through it compressed air washed through a solution of NaOH. The outlet tube of the NaOH wash bottle was thoroughly protected by a "hood" of filter paper to keep out any spray from NaOH. No ammonia was detected in the compressed air. By this method it was found that in many cases an acid, upon penetrating, combined immediately with the basic ions previously present in combination with CO_2 . The latter was liberated as carbonic acid, which was the acid directly responsible for the observed increase of acidity, and which could be removed by aeration. Any change of pH still remaining after aeration would then be due to acid penetrating from the exterior solution in excess over the amount needed to displace the carbonic acid.

It was thought that perhaps some of the acids entering the cells were volatile enough to be bubbled off by this method, thereby giving wrong values for the H-ion concentration of the sap; but in no case could any change of pH be produced by aeration of sap from cells previously in solutions of such acids.

In all figures each curve represents one typical experiment. In every case a number of experiments have been performed, varying from 6 in cases which gave concordant results to 10 or more in those which were less certain. For each experiment the number of plants used is shown by the points on the curve. Each point represents one observation made upon the sap of one plant.

The probable error was determined for a few cases and found to be about 1 per cent.

RELATION OF SIZE OF PLANT TO RATE OF PENETRATION OF ACID.

It was soon discovered that cells of the same size had to be chosen for all the experiments in order to obtain consistent results. Crozier (6) also had made this observation in the case of *Chromodoris*. He assumes that the distance to which acid must have penetrated in order to occasion the indicative color change is essentially a constant quantity in the case of *Chromodoris*, quoting Conklin (14) to the effect that "in mollusks the cell size is not a function of body size but is constant during by far the greater part of the life duration." In *Valonia* the size of the cell and vacuole changes with the age of the plant; and when acids appear to penetrate more slowly, this may be due to the greater distance through which substances must

diffuse in order to pass from the periphery to the center of the vacuole, or vice versa. That simple diffusion controls, to a considerable extent, the rate of change of the pH of the sap of *Valonia* is illustrated by the following experiment: If the sap from a single cell which had been previously placed in certain of the acids was forced out continuously, without releasing the pressure, into several successive tubes, each containing indicator, it was found that the acidity changed in the successive tubes. For this reason, when making a single determination of the acidity of the cell sap, all of the sap was used and only the average acidity was recorded. This precaution was found to be unnecessary in the case of those acids which penetrate so

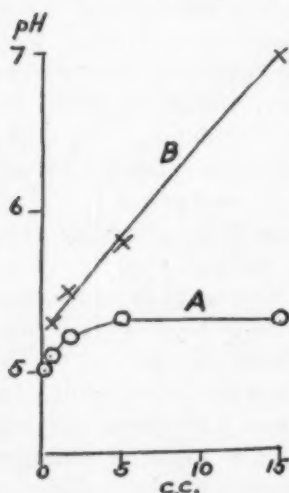


FIG. 1.—Relation of size of plant to rate of penetration of HCl into the cell sap of *Valonia* in one hour. The ordinates represent pH, and the abscissæ show the number of cubic centimeters of sap contained by the plant.

The abscissæ represent the number of cubic centimeters of sap which the cell contained and the ordinates represent the pH of the sap after the cell had been in HCl for one hour.

Curve "B" shows that the H-ion concentration of the sap when the free CO_2 was removed was considerably less than that in its presence. Thus, the first point shows that when the CO_2 was eliminated from the sap of a cell containing 0.5 c. c. of solution the residual pH was 5.3. In the same way points 3 and 4 show that when the plants contained 5 c. c. and 15 c. c., respectively, of cell sap, the residual pH was 5.8 and 7.0.

In the first two cells, which are the smallest, there is not so much bicarbonate to be acted upon and, therefore, less CO_2 to be liberated. In other words, the greater the diameter the smaller the ratio of the

rapidly that diffusion is a negligible factor. One can readily understand that cells having a diameter of 10 mm. might be expected to give different results from those the diameter of which is 25 mm. For all the experiments here described, only those cells having a diameter of 13 mm. were used, unless otherwise specified, as it was found that these were most convenient to handle and gave reliable and consistent data. In order to obtain the proper grading, a piece of cardboard with an opening of 13 mm. in diameter was used for measuring the cells (on the principle used in grading fruit). The relation of size of plant to rate of penetration of acid is illustrated in Figure 1.

Figure 1 shows the relation of the size of *Valonia* to the rate of penetration of HCl when the plant was left in a solution consisting of sea water in which enough HCl had been dissolved to produce a pH of 3.6.

area of the cell surface to the volume of the cell, and therefore the less acid will enter in any given time per gram ion of HCO_3 to be decomposed, and the slower the apparent penetration. That diffusion plays a rôle in some cases of slower penetration is very probable. That larger plants have a higher concentration of bicarbonates to decompose is also probable, inasmuch as the pH of the sap of large plants is normally considerably higher than that of smaller plants. The initial pH of the plant represented by point "4" in Figure 1 was probably about 7.4 (as indicated by controls which had been previously observed).

THE EFFECT OF ACIDS UPON LIVING PLANTS.

The characteristic difference between the action upon protoplasm of mineral acids and that of organic acids is the subject of much discussion. It is hoped that the observations here recorded may throw some light upon this problem.

It was found that the acids used in these experiments could be grouped into two broad classes. The behavior of carbonic acid was found to be sufficiently characteristic to make it seem desirable to devote a separate paper to its discussion.

The first class comprises those acids which, in penetrating, displace all or most of the bicarbonates, producing a great deal of free CO_2 , which persists for a considerable length of time. These acids are hydrochloric, nitric, sulphuric, arsenic, phosphoric, oxalic, citric, tartaric, trichloroacetic. To this list must be added mono- and dichloroacetic acids, which appear to penetrate more rapidly and maintain free CO_2 for a much shorter time.

To the second class belong benzoic, butyric, and acetic acids, which give no evidence of CO_2 liberation; and salicylic acid liberated so slight an amount that it has also been included.

The acids of the first class are more strongly dissociated than those of the second class, which, with the exception of salicylic acid, are very slightly dissociated (see Table I). The acids of the second class are also distinguished by the fact that they belong to the class of substances which Hantsch terms "pseudo-acids." The significance of this fact has been discussed by Loeb in a recent paper (9). They are more toxic than acids of the first class (except mono- and dichloroacetic acids). It will also be evident that a quite different set of reactions is induced in the cell by acids of the second class.

Figure 2 shows the effect upon the cell sap of *Valonia* of immersing the plant in sea water in which enough acid was dissolved to give a pH of 3.6. The three mineral acids used are represented by the following symbols: hydrochloric, open and closed circles; nitric, open triangles and underlined circles; sulphuric, closed triangles and crosses.

The ordinates show the pH of the sap. An initial pH of 6.6 is always indicated for curve "B," as that was the average normal pH of

the cell sap from which CO_2 had been removed, and an initial pH of 6.2 was always indicated for curve "A," indicating the usual pH of the sap with CO_2 present. The abscissæ show the time in minutes, beginning at the moment the cells are placed in the acid solution.

Curve "A" shows the reaction of the sap when CO_2 is allowed to remain. These curves are identical in the first part of the reaction but vary in the latter part on account of varying rates of penetration of these three acids. Sulphuric acid is the slowest of any studied; the dotted lines show that an interval of five hours elapsed without a change in pH. It seems as if the SO_4 has an effect upon the penetration of the H-ion. Since SO_4 is absent from normal sap (15), it seems probable that the same mechanism acts here as acts to prevent the penetration of sulphuric acid.

Curves "B" show the pH value of the sap when CO_2 has been removed. These curves are all more or less identical in shape

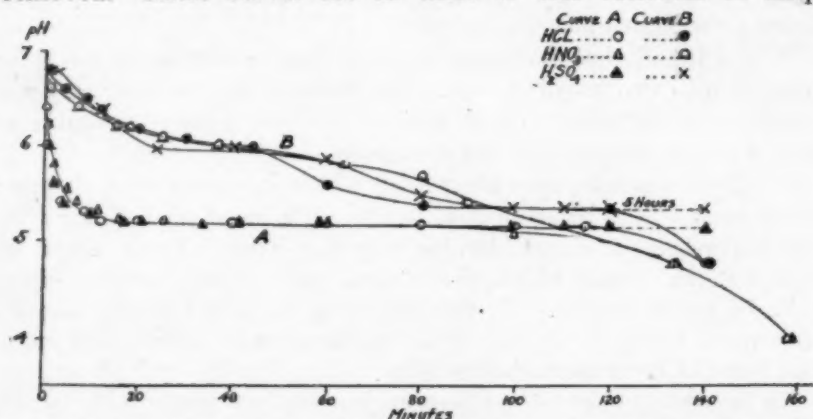


FIG. 2.—H-ion concentration of the sap of *Valonia* when placed in sea water containing, respectively, HCl , HNO_3 , and H_2SO_4 . "A" curves represent the pH values of the sap when CO_2 is present, and "B" curves when CO_2 has been removed. Abscissæ show time in minutes, and the ordinates represent the pH values.

except that the horizontal portions are longer or shorter, depending upon the acid used. HCl and HNO_3 , which show a short horizontal portion, are also more toxic than H_2SO_4 , as shown by the length of time cells survive in sea water. After the cells have been a given length of time in acid, HCl and HNO_3 penetrate in about the same time and are about equally toxic. In the experiments on survival, summarized in Table I, all plants were returned to sea water after having been in acid the indicated length of time. Only cells of the same size as were used for the other data were included. The time they survived was reckoned from the time they were returned to sea water until they cytolized. Thus, after 90 minutes in HCl , the cells cytolized in five days; after three hours, in two days. After 45 minutes in HNO_3 , they cytolized in four days; after five hours, in one day. Normal cells live under laboratory conditions in sea water from 10 days to one month.

The data in Table I do not purport to be complete. They give a comparative idea of the length of life and amount of injury in some of the acids used. It is readily seen here that those acids which decompose bicarbonates are not so toxic as those acids which enter without acting on the bicarbonate. It might be possible to determine what proportion of the bicarbonates may be decomposed

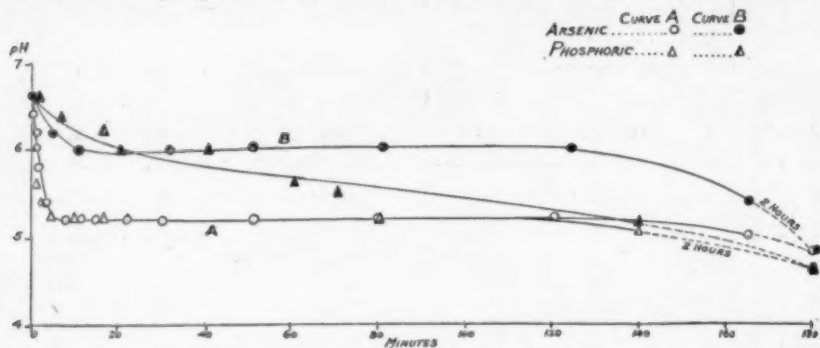


FIG. 3.—Changes in the H-ion concentration of the sap of *Valonia* when placed in solutions of arsenic and phosphoric acids. Curves "A" show the pH values when CO₂ has not been removed, and curves "B" show the pH values when CO₂ has been removed. The ordinates represent the pH of the sap, the abscissae the time in minutes.

without causing irreversible injury. Those acids which penetrate without acting upon the bicarbonates produce irreversible injury almost immediately. Stated in other words, it seems that the

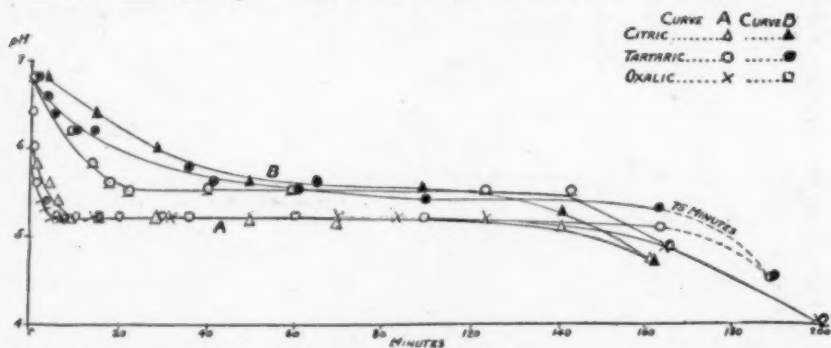


FIG. 4.—Changes in the H-ion concentration of the sap of *Valonia* when placed in solutions of citric, tartaric, and oxalic acids. Curves "A" show the pH when CO₂ is present, and curves "B" show the pH when the CO₂ has been removed. The ordinates represent the pH of the sap, and the abscissae show the time in minutes. The dotted lines indicate 75 minutes.

presence of bicarbonates affords a protection against injury by highly dissociated acids.

The descriptions for the following figures are identical with the explanation of Figure 2 and will not be repeated. The only differences are in the kind of acid used.

Figure 3 shows results obtained with arsenic acid ($2\text{AsO}(\text{HO})_3 \cdot \text{H}_2\text{O}$) and phosphoric acid (H_3PO_4). The dotted lines show an interval of

two hours elapsing before the A and B curves coincide. Curves A are almost identical for these two acids and resemble those of Figure 2 also. Curves B are also much like those of Figure 2.

These acids are slightly less toxic than HCl. Cells allowed to remain in arsenic acid for three hours cytolyzed in three days; for one hour, five days. In the case of phosphoric acid they cytolyzed in one day after six hours in the solution, and in four days after four hours in the solution.

Figure 4 gives the results with citric ($(\text{CH}_2 \cdot \text{CHOH} \cdot \text{CH}_2 \cdot \text{COOH})_3$), tartaric ($\text{CHOH} \cdot \text{CHOH} \cdot (\text{COOH})_2$), and oxalic $(\text{COOH})_2$ acids. These curves are similar in form to those of the preceding figures. Penetration seems to be somewhat more rapid. Survival data were obtained for citric acid alone. After one hour in this acid, the plant

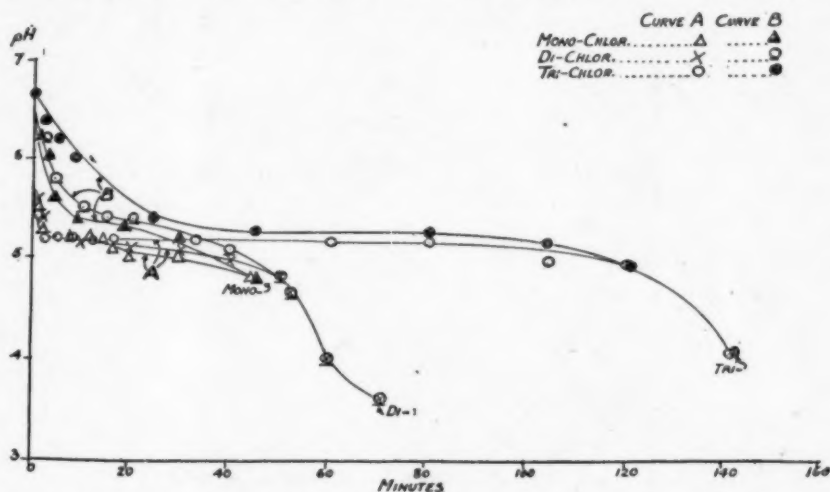


FIG. 5.—Changes in the pH value of the sap of *Valonia* when placed in solutions of mono-, di-, and tri-chloroacetic acids. Curves "A" show the pH when CO_2 is present, and curves "B" show the pH when CO_2 has been removed. The ordinates represent the pH values of the sap, and the abscisse show the time in minutes.

lived nine days. Citric acid is therefore considerably less toxic than the other acids mentioned above.

Figure 3 represents the results with mono- di- and tri- chloroacetic acids (CH_2ClCOOH , CHCl_2COOH , and CCl_3COOH). These acids are much more toxic than those noted in the preceding paragraph. After 12 minutes in monochloroacetic acid the cells cytolyzed in two days, and after 22 minutes, in one day. After 14 minutes in dichloroacetic acid they cytolyzed in two days when transferred to sea water, and after 35 minutes they cytolyzed in one day. Trichloroacetic acid was less toxic than the other two chloroacetic acids. After 6 minutes in this acid, the plants lived 10 days in sea water, and after 30 minutes they lived 6 days.

Contrary to expectation it was found that trichloroacetic acid was less toxic and less rapid in bringing the sap to the ultimate pH of 3.6 than the other two acids of the series. These results do not agree with those of Harvey (16) and Crozier (6). Harvey states that all three acids penetrate tissue within the same time approximately from 0.01 N solutions; and Crozier states that ionization determines the relative penetrating ability within groups of acids having chemical relationship. It is noteworthy that trichloroacetic acid, which is a strongly dissociated acid, produced results approximating those of

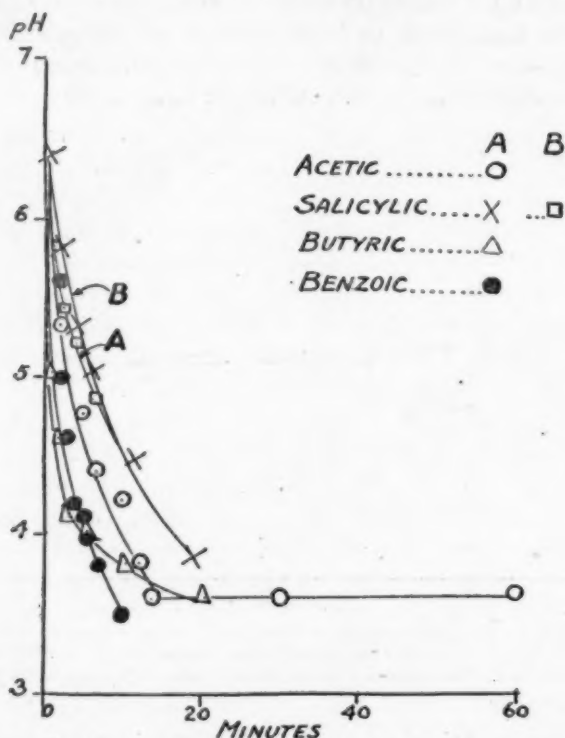


FIG. 6.—H-ion concentration of the sap of *Valonia* when placed in solutions of acetic, salicylic, butyric, and benzoic acids. (Salicylic acid is the only one of this group having two curves, as there was a slight amount of CO_2 liberated.) The ordinates represent the pH values of the sap, and the abscissae show the time in minutes.

the mineral acid, HCl , whereas mono- and di-chloroacetic, which are less strongly dissociated, penetrate more quickly than the other acid of this series.

If the curves "A" in the following figures alone were considered, the writer might also have concluded that the penetration of the three acids is almost identical. However, curves "B" show a decidedly different set of conditions. The "A" and "B" curves of tri-chloroacetic acid coincide much later than those of mono- and

di-chloroacetic acids. This suggests that a great deal more bicarbonate is decomposed by the more strongly dissociated acid.

Figure 6 shows the rate of penetration of the following acids: acetic, butyric, salicylic, and benzoic (CH_3COOH , $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$, $\text{C}_6\text{H}_4\text{OHCOOH}$, $\text{C}_6\text{H}_5\text{COOH}$). These acids were grouped together because of the rapid entrance of the acid and the absence of CO_2 liberation, except in the case of salicylic acid, which liberated a very slight amount.

These acids are all very toxic, except salicylic, which is the least toxic of this class. Table I shows that when the plants were allowed to remain in acetic acid for 42 minutes, they cytolized the next day; after 7 minutes they cytolized in three days. When they remained in butyric acid for either 30 seconds, 2, 4, or 11 minutes, they cytolized in one day; after 31 minutes they cytolized the same day. In the case of benzoic acid they survived one day after having been in a solution of this acid for only 5 minutes. In salicylic acid, which is not so toxic, they survived three days after having been in this solution for 27 minutes. Since salicylic acid liberated some of the bicarbonates, its effect on the viability of the cell agrees with the concept that those acids which act on the bicarbonates of the cell are less toxic than those which penetrate without this reaction.

If a penetrating acid of the first class liberates the CO_2 of the cell by decomposing the bicarbonates, it would be expected that those cells which had been in this acid long enough would have lost the whole of their bicarbonates, and after having been transferred to sea water long enough for all the free acid to diffuse from the cell, would show rapid penetration of this acid. This was proved to be the case by the following experiment: Cells had been kept in the usual solutions of HCl long enough to have a pH below 5.0 and then transferred to sea water till their pH became 8.6. When, after this, they were returned to HCl solution, the sap became acid very rapidly. Cells which had been kept in an acetic acid solution (acid of the second class) for a few minutes until the required pH of the solution was attained and then transferred to sea water until the pH of their sap became 8.6, were likewise placed in HCl solution, but the penetration of HCl took place in the usual manner, i. e., very slowly, thereby showing that in the latter case there is no alteration in the manner of penetration of HCl whereas in the former case the absence of bicarbonate hastens the penetration of HCl. Crozier (17) also found that to be the case, although he has attributed another reason for this increased rate of penetration.

These cells in both cases are dead, but the experiments with the cells killed by other methods show that this rapid increase of H ion concentration is not due to the fact that the cell is dead.

EXPERIMENTS WITH DEAD CELLS.

It is a matter of general opinion that when tissues are dead, substances penetrate "instantly." It was therefore thought of interest to make some quantitative observations upon the penetration into dead cells of some of the acids studied in the preceding pages.

Two sets of dead plants were used—those which were killed by boiling in sea water for 10 minutes and those which were found dead. Those which had been boiled and cooled to 24° C. before use became bright green in color, soft and dull, but the protoplasm remained intact. It was thought that this control would show the rate of penetration through dead protoplasm. Other cells which were

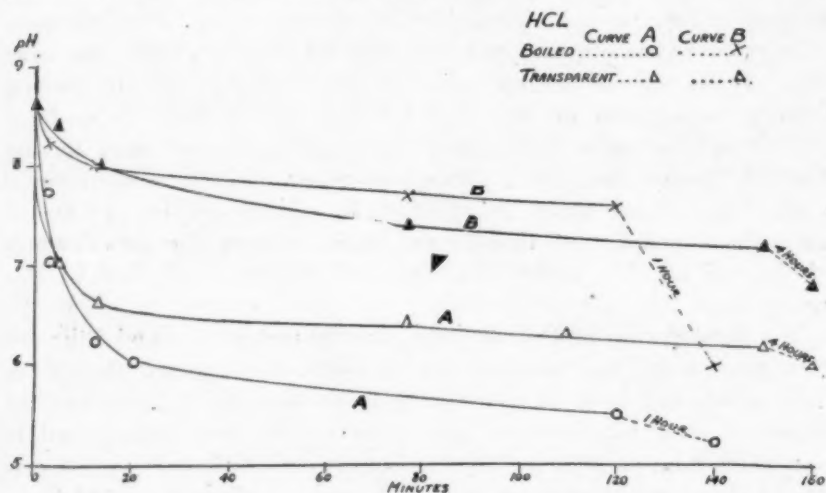


FIG. 7.—Effects on the pH of the sap of dead plants when placed in solutions of HCl. Curves "A" show the pH when CO_2 has been allowed to remain, and curves "B" show the effects when CO_2 has been removed. Ordinates represent pH values, and abscissae time in minutes.

found dead in their natural habitat, sea water, were transparent, and the protoplasm could be seen through the wall in small dark green or black disintegrated particles floating loosely in the sap. The cell sap of all of the dead plants, boiled or not boiled, was of the same pH as the sea water of this locality (8.6) with free CO_2 , and pH 9.0 without free CO_2 . Therefore in all of the figures concerning dead plants the initial pH is shown as 8.6.¹ In some cases the results obtained with these two sets of dead plants were identical, and therefore only one set of symbols was used; in those cases in which there was a difference in the action of the acids upon dead plants, the two sets of curves were included.

¹ In the figures illustrating the effects on dead plants the initial pH of all of the curves was 8.6; but where a great many symbols were used, it was impossible to designate their origin at one point, and hence most of them were omitted at zero minutes.

Figures 7 to 9 include the rate of penetration of solutions of HCl, HNO_3 , and H_2SO_4 . Here again the buffer effect of the sap of dead

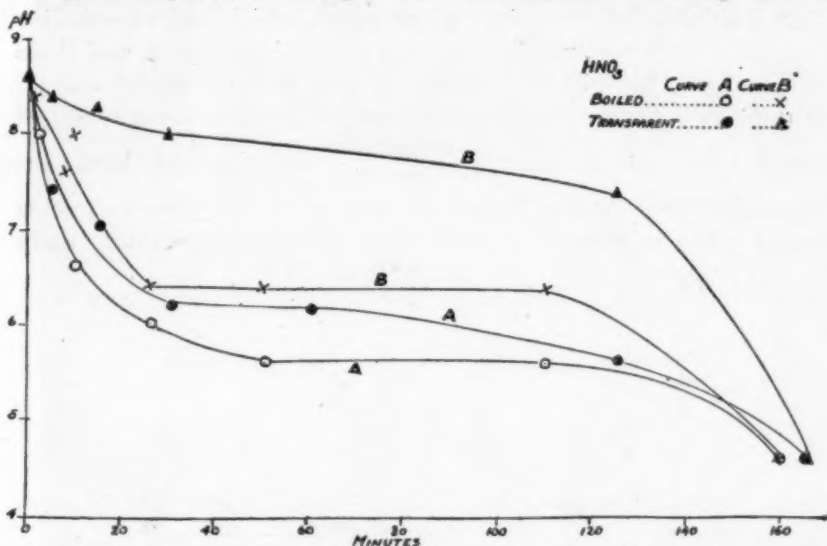


FIG. 8.—Rate of penetration of nitric acid into dead cells. Curves "A" show the pH when CO_2 is present, curves "B" when it is removed. Ordinates represent pH values of the sap, abscissae the time in minutes.

cells is seen, with free CO_2 (Curve "A") and without CO_2 (Curve "B"). The pH of living cells is 6.4, whereas that of dead cells is

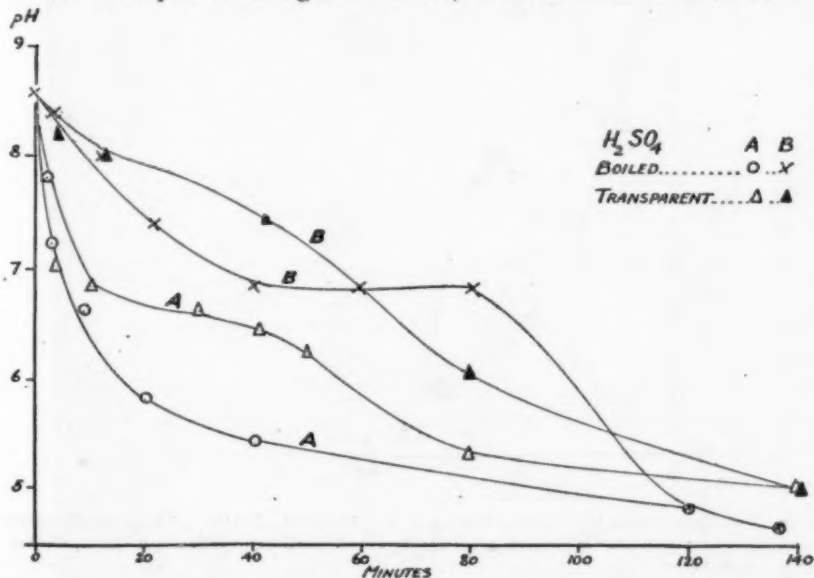


FIG. 9.—Rate of penetration of sulphuric acid into dead cells. Curves "A" show the pH when CO_2 is present, curves "B" when CO_2 is removed. The ordinates represent the pH values, the abscissa the time in minutes.

8.6. The buffer effect in dead cells is in the carbonic acid-bicarbonate range (approximately 8.0), and continues until, as the bicarbonate-

carbonic acid transformation approaches completion, the acidity of the sap increases more rapidly.

The rate of penetration into those plants which had been boiled is, in some cases, faster than that into transparent plants, and these acids cause an immediate liberation of CO_2 in large quantities.

Taking into consideration the differences in the initial amount of combined CO_2 , and the ratio, $\frac{\text{carbonic acid}}{\text{bicarbonate}}$ of living and dead cells, it is difficult to draw exact conclusions as to the rate of penetration of acids. But in general it appears that HCl penetrates more slowly

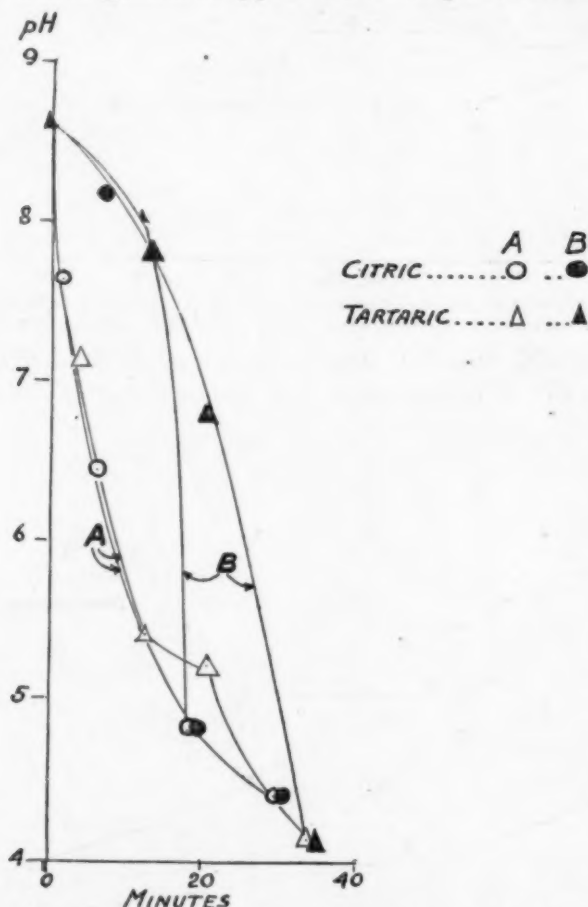


FIG. 10.—Rate of penetration of citric and tartaric acids into dead cells. Curves "A" represent pH values when CO_2 is present, curves "B" when CO_2 has been removed. Ordinates represent pH values, abscissae the time in minutes.

into dead than into living plants, and still slower into transparent (i.e., naturally dead) plants. In the case of nitric acid, penetration is about as rapid in dead as in living plants. In the case of sulphuric acid, on the other hand, penetration is more rapid in both

kinds of dead plants than in living plants. As some of the curves were too long to be included in the graphs, dotted lines indicate the time interval elapsing.

Penetration of these three acids is of interest on account of the relative concentration of their anions in the sap of living *Valonia*. Here most of the salts are in the form of chlorides (12); the concen-

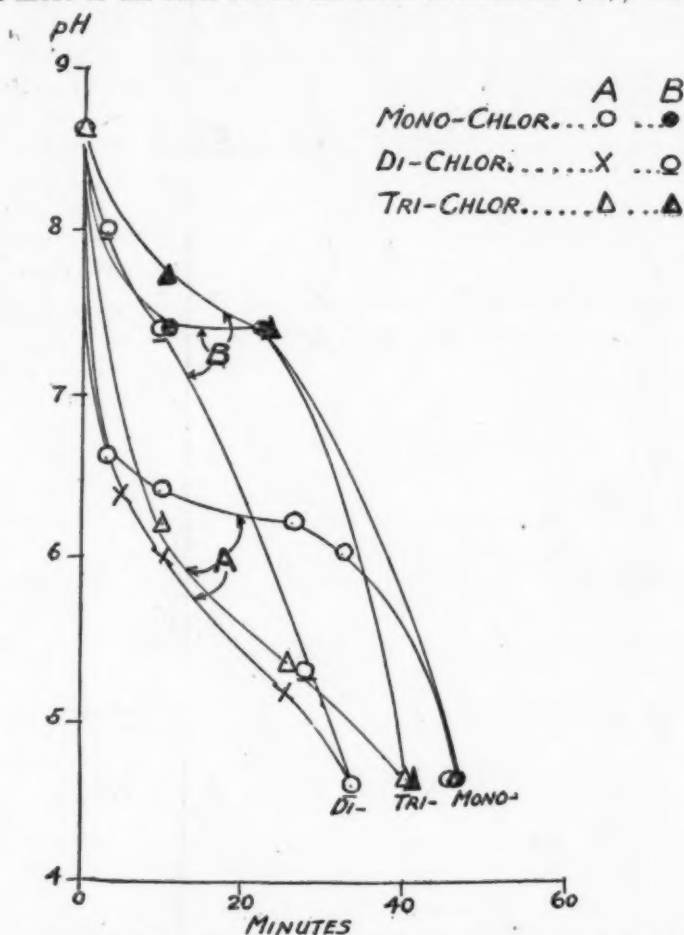


FIG. 11.—Rate of penetration of chloroacetic acids into dead cells. Curves "A" show the pH values when CO_2 is present, curves "B" when CO_2 has been removed. Ordinates represent the pH values of the sap, abscissa indicate the time in minutes.

tration of nitrates is greater than in sea water, but there is no sulphate in living plants (15). When plants die, SO_4 enters readily. It seems as if the same mechanism which regulates the presence or absence of these anions in living cells also regulates the penetration of the anions of these acids. Thus, in living plants HCl and HNO_3 enter at about the same rate, whereas the rate of penetration of H_2SO_4 is

much slower. In dead plants HNO_3 enters at the same rate as in living plants; HCl is slower than in living plants, and H_2SO_4 is much more rapid than in living plants. The importance of diffusion con-



FIG. 12.—Rate of penetration of benzoic and salicylic acids into dead cells. Curves "A" show the pH values of the sap when CO_2 is present, curves "B" the values when CO_2 has been removed. Ordinates represent the pH values of the sap, abscissae the time in minutes.

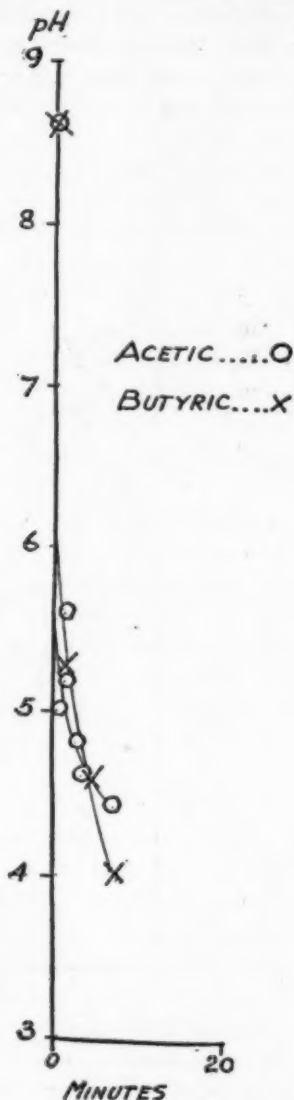


FIG. 13.—Rate of penetration of acetic and butyric acids into dead cells. The ordinates represent the pH values of the sap, and the abscissae show the time in minutes.

stants of acids and of salt effect is explained by Loeb (18), and must of necessity have considerable bearing upon the explanation of these results.

Citric and tartaric acids enter much more rapidly into dead than into living plants. The curves for transparent and for boiled plants were the same, and, hence, only one set is indicated in the figures. (Fig. 10.)

The rates of penetration of the chloracetic acids into dead cells differ from those observed for living cells. In the case of trichloracetic acid the rate of penetration into dead plants greatly exceeds that into living plants; di-chloracetic acid penetrates somewhat more rapidly; and mono-chloracetic differs little in rate. The three acids which penetrate living plants at widely different rates, besides differing in the amount of CO_2 liberated (Fig. 5), now penetrate at comparable rates and differ only moderately in the amount of CO_2 liberated (Fig. 11). There is no difference in the rate of penetration of any of these acids into boiled and transparent plants.

Figure 12 shows the results with salicylic and benzoic acids. The results for boiled and for transparent plants were identical. A small amount of CO_2 is liberated by both these acids; and in this respect the behavior of benzoic acid differs in its effects on living and dead plants, no CO_2 being liberated in the former case. This difference prevents exact comparison of the permeability of the cells to benzoic acid in the two cases, but it appears to be much greater in the case of living cells. Salicylic acid seems to penetrate living and dead cells at about the same rate.

In the case of acetic and butyric acids (Fig. 13) no liberation of CO_2 was noted. This is true for both boiled and transparent plants, the curves of which are identical. The rate of penetration of these two acids seems to be about the same in living and in dead plants.

DISCUSSION.

The methods here recorded have enabled the writer to determine the rate of penetration of various acids from moment to moment during the entire process, and to show that this is not a simple or orderly process. The data show that it is not sufficient to adopt an arbitrary pH interval by which to measure the rate of penetration, as previous writers have done. In studying the penetration of acids into plants the reactions produced within the cell by each acid must be considered. It is evident that the liberation of CO_2 from the bicarbonates is a process which plays an important part in the case of some acids. After the bicarbonates are used up, the acidity immediately increases, showing that the presence of bicarbonates is very efficient in maintaining the pH above 5.0. The value of this device as a protection against destruction is apparent. This process occurs in the case of certain acids only and is absent in others.

The significance of the rate of production of CO_2 is as follows: Where a great amount of CO_2 accumulates slowly, it may be supposed

that the bicarbonates are being decomposed in the same way that they are decomposed by mineral acids when they are mixed *in vitro*; where a smaller amount of CO_2 is indicated, it may be surmised that there is some effect acting secondarily to retard or prevent the liberation of CO_2 , or to prevent the decomposition of bicarbonates by the entering acid. While acids producing the last type of action are able to decompose bicarbonates *in vitro*, they apparently do not do so in the living cell. They must therefore so alter the nature of the cell as to produce this phenomenon, or they may suffer some displacement of the equilibrium between the dissociated, normal, and "aci-forms" of the pseudo acid, such as might be produced through the agency of the protoplasm; or they may accumulate in a phase in which bicarbonate is absent. Thus they are seen to produce in the cell, effects not produced by acids of the first class; they are also far more toxic, as evidenced by tests of subsequent viability. The decomposition of a considerable portion of the bicarbonates does not appear to be excessively injurious. Only when, for some reason, this reaction is absent, does the extreme toxicity of the acid exhibit itself.

In these studies it is assumed that changes of the pH of the sap are due to penetration of both ions of the acid rather than to exosmosis of ions from the interior. It would undoubtedly be very desirable to verify this assumption by chemical analysis of the sap; but, unfortunately, it is seldom possible to do this, especially in the case of strong acids, because these are applied in concentrations which are below the limits for successful quantitative analysis. In the case of chlorides the results would be masked by overwhelming amounts of chlorides already present in the sap.

However, in two cases which have been observed by the writer, there is direct evidence of the penetration of the acid used. In the case of cells which have been in butyric acid solution, there is an unmistakable odor of butyric acid in the sap when it is expressed. The butyrate ion has therefore penetrated through the protoplasm and cell wall into the sap.

The penetration of arsenic from solutions of arsenic acid may be proved by analysis. There is normally almost no arsenic in the cell sap, and the Gutzeit method of arsenic analysis is delicate enough to detect the minute quantities (a few micromilligrams) of arsenic entering. Rough calculations show a surprising agreement between the change of pH calculated from the observed arsenic content (by assuming that it is in the form of arsenic acid) and the change of pH observed.

It is therefore to be presumed that the other acids used produce their effects upon the pH of the cell sap by penetration of both ions of the acid, and not by inducing any exosmosis of basic substances.

These considerations can not be applied to cells which have become moribund under the influence of the acid.

The acids studied could be separated into two distinct groups—those which caused a liberation of CO_2 from bicarbonates and those which did not.

The first class included hydrochloric, nitric, sulphuric, arsenic, phosphoric, oxalic, citric, tartaric, and mono-, di-, and tri-chloracetic acids. Neither rate of penetration nor toxicity of these acids can be correlated with their percentage dissociation, partition coefficients, or surface tension effects as has been pointed out by Harvey (3). However, they all reacted upon the bicarbonates of the cell. That living protoplasm is not the only factor controlling the rate of penetration of these acids is seen by reference to the experiments on dead plants.

The acids of the first class are all more or less strongly dissociated. In strong contrast with these acids are those of the second class. They include the very weak acids—acetic, butyric, and benzoic, besides salicylic, which is the strongest of this group. Failure to show liberation of CO_2 in living plants characterizes all except salicylic, which produces only a very small amount. In dead plants both salicylic and benzoic acids liberate small amounts of CO_2 .

Decomposition of bicarbonates may be said to be at least partly dependent upon percentage dissociation of the acid. (It is supposed that dissociation of acids is approximately the same when they are dissolved in sea water as in distilled water, but figures are not available.) This is illustrated broadly by the action of the strong acids as compared with that of the weak ones. The behavior of the chloracetic acids show that this is not the only factor determining the rate of penetration. Neither is the pseudo-acid character of acids of the second class alone able to explain all the facts. Chemical union with protoplasm, salt effects, lipoid solubility, partition coefficients, and so on must be considered before the nature of penetration of acids is entirely understood.

SUMMARY.

The penetration of several acids of different types through the cell wall and protoplasm into the cell sap of *Valonia ventricosa* has been studied.

1. Combined carbon dioxide (bicarbonate) present in the cell sap before exposure of the cells to the acid solution was found to exert a marked effect on the apparent rate of change of pH of the cell sap, which does not fall below pH 5.2 until the bicarbonate has all been displaced by the entering acid.

This factor, which probably affects protoplasm itself, has heretofore been entirely neglected.

2. The acids studied may be divided into two groups, the acids of one of which liberated CO_2 and appeared to penetrate more slowly than they actually do. This group includes hydrochloric, nitric, sulphuric, arsenic, phosphoric, oxalic, citric, tartaric, and mono-, di-, and trichloracetic acids.

The second group of acids includes acetic, salicylic, butyric, and benzoic acids, which are unable to replace CO_2 (except very slightly in the case of salicylic acid) and penetrate with great rapidity.

3. Evidence is submitted to show that living protoplasm is not the only agency regulating the rate of penetration of acids, since dead cells behave somewhat like those which are alive.

Acknowledgments.—The writer takes pleasure in acknowledging the courtesies afforded by the Miami Aquarium Association, where this work was done, and in expressing much gratitude to the authorities of the Carnegie Institution of Washington, D. C., who made arrangements for collecting plants.

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STUDIES ON THE PERMEABILITY OF LIVING AND DEAD CELLS.

II. OBSERVATIONS ON THE PENETRATION OF ALKALI BICARBONATES INTO LIVING AND DEAD CELLS.

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In the previous paper, dealing with the effects of acids upon the protoplasm of living and dead cells, carbonic acid was not included because of the characteristic changes which it produces in the cell-sap of *Valonia*. In the case of other acids there is a progressive

increase in the acidity of the sap until its pH is equal to that of the solution in which the plants are immersed, whereas in the case of carbonic acid the increase in acidity is only temporary and is followed by a progressive increase of alkalinity. It was thought of interest to study the pH of the cell sap of *Valonia* when it is immersed in a solution containing carbonic acid or its salts.

Among the acids used, carbonic acid is peculiar in yielding alkali metal salts capable of hydrolytic dissociation which thus furnish an opportunity for studying the penetration of their two ions separately, and for determining whether either of them affects the permeability of protoplasm to other ions. Carbonic acid is also normally present in the cell.

A description of the method used for determining the pH of the sap of *Valonia* was given in the preceding paper and will not be repeated here. Suffice it to say that two sets of pH determinations were made—one set upon freshly extracted sap containing all its free CO_2 , and the other set upon the same samples of sap after the CO_2 had been removed by aeration with CO_2 -free air.

Immersion of normal cells in acids such as HCl and HNO_3 lowers the pH of the sap to about 5.2, at which point the acidity remains fixed for a considerable time, only ultimately going on to a higher acidity and death. The curves representing as a function of time the pH of the sap of cells placed in these acids, show a general tendency to "flatten out" at a pH of 5.2. This is probably due to a steady decomposition of bicarbonates with liberation of CO_2 , but other substances which have a buffer action at pH 5.2 may play a part. The buffer effect of the bicarbonate-carbonic acid system lies at a pH between 7.0 and 8.0 when the system is in equilibrium with ordinary air, but increased CO_2 tension would cause this range to lie at a lower pH. If the intracellular CO_2 tension were raised to that of air containing about 3 to 5 per cent of CO_2 , the pH of the buffer range would be about that actually observed (5.2). At this pH an accumulation of acid would therefore be needed before further change in reaction occurred. Even when sea water is saturated at atmospheric pressure with CO_2 so that its pH becomes 5.4, the pH of cell sap of plants placed in this solution does not exceed 5.2.

There is undoubtedly a balance between the production of respiratory CO_2 and its escape from the cell; and under ordinary conditions this mobile equilibrium keeps the H-ion concentration of the sap approximately constant. There seems to be an intracellular CO_2 tension normal for *Valonia* and responsible for the observed differences between the pH of sap with and without free CO_2 . These differences are normally about 0.6 of a pH unit (6.2 to 6.8). When the balance is upset, changes in the permeability of the protoplasm or alterations in the distribution of ions between the sap and protoplasm take place. This is nicely illustrated in the following simple experiment: By

allowing cells to remain in sea water containing enough CO_2 to produce a pH of 6.8 to 7.0, an abnormally large amount of CO_2 was made to accumulate in the sap, which became acid, attaining a pH of 5.2 to 5.3. After a time the pH of the sap when free CO_2 was removed began to increase in spite of the fact that the cells were in a solution the pH of which was 7.0 until the alkalinity approached pH 8.0 in three hours.

Observations on the effects of sodium and potassium bicarbonates dissolved in sea water, upon the pH of the cell sap show that, as in the case of sea water containing free CO_2 , there is at first a rapid increase of acidity and of free CO_2 in the sap. After a time the acidity decreases gradually and the pH finally approaches or even exceeds

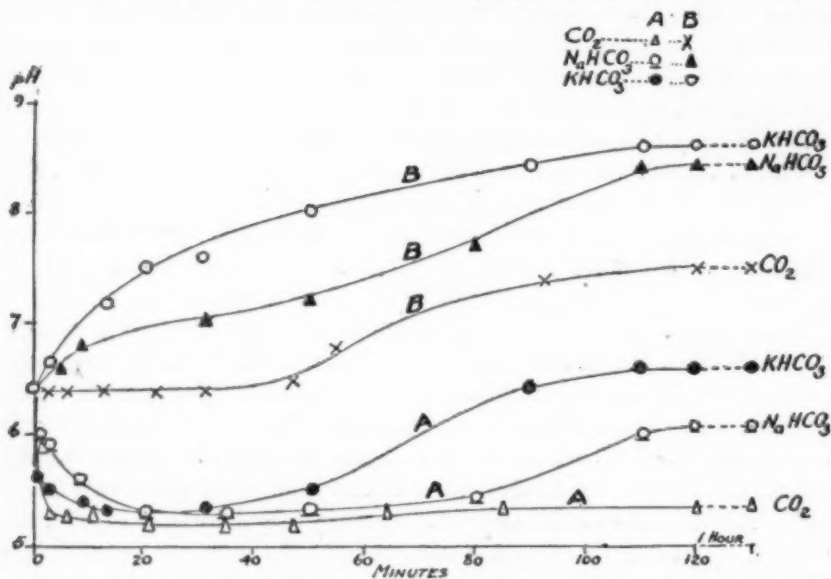


FIG. 1.—Rate of penetration of free CO_2 into the cell sap of *Valonia* from solutions of sea water containing either free CO_2 alone or KHCO_3 or NaHCO_3 (0.03 M) (curves "A"). Curves "B" show the changes in alkalinity of the sap. The ordinates represent the pH values, the abscissae the time in minutes.

that at the beginning of the experiment. This is connected with an increased alkalinity of the CO_2 -free sap, which begins immediately and proceeds until the pH approaches that of the external solution when the latter is freed from CO_2 (9.0 to 9.2). The curves in Figure 1 show the effects of placing *Valonia* in solutions consisting of 200 c. c. of sea water containing KHCO_3 , 0.03 M, NaHCO_3 in the same molecular concentration, or enough free CO_2 to produce a pH of 6.8 to 7.0. The pH of the potassium and sodium solutions was about 7.9 in sea water. When freed from CO_2 their pH was 9.0 to 9.2. Curves "A" show the pH of the sap before and curves "B" after the free CO_2 has been removed. The concentration of the CO_2 in the cell sap is increased most rapidly when the cells are placed in solutions contain-

ing CO_2 only, but the data representing penetration of CO_2 and other ions from such a solution are not quantitatively comparable to those of the other curves (KHCO_3 and NaHCO_3), inasmuch as CO_2 was present in a much higher concentration. The curves for sodium and potassium bicarbonate solutions are comparable, and show that CO_2 penetrated more rapidly from the latter. Curves "B" also show differences in the rate of the changes producing alkalinity. Here again the change is more rapid when KHCO_3 has been used than when NaHCO_3 is present. Increased alkalinity might be due to substances given off by the protoplasm, but is more probably due to entrance of ions from the external solution.

The objection might be raised that this increase of alkalinity was due not to entrance of bases but to exosmosis of acids presumably other than carbonic. However, it is very improbable that carbonic acid should displace any stronger acid, and anions of weaker acids have not yet been found in the sap of *Valonia*.

In order to find direct evidence for the penetration of Li, LiCO_3 (0.03 M) was added to sea water and enough CO_2 added to produce a pH of 7.0; the sap of *Valonia* became pH 5.3 in a few minutes, and the CO_2 -free sap became alkaline gradually as in the case of Na and K bicarbonates. When cells of *Valonia* were allowed to remain in this solution for four hours, and their sap then collected and evaporated nearly to dryness, it was not possible to demonstrate the presence of Li by spectroscopic analysis. This is of interest because in the case of *Nitella* (1), a fresh-water alga, the writer found Li in the sap of plants which had been in a 0.05 M solution for 24 hours. The time element may account for this difference, but the penetration of Li in the case of *Nitella* was much slower from a balanced solution than from an unbalanced one. As the salts of balanced solutions affect the penetration of other salts into living cells, it is possible that the concentration of the salts of sea water in the case of *Valonia* prevented the entrance of more than a trace of Li; whereas in the case of *Nitella* the Li penetrated readily because of the low salt concentration of the surrounding medium.

Then, too, the change in the pH of the CO_2 -free sap of *Valonia* was from 6.6 to 8.0. If this increase in alkalinity were due entirely to the penetration of Li compounds, its concentration could not be more than about 1×10^{-6} N. Since it was possible to detect solutions of LiCl of 1×10^{-3} but not 1×10^{-4} N, it is quite probable that Li entered the cell of *Valonia*, but in amounts too slight to be detected by the spectroscope.

The length of survival of plants treated with the above solutions was also determined. It was found that normal cells lived under laboratory conditions in running sea water from 10 days to 1 month, whereas most of the plants which had been obviously injured during

the process of experimentation cytolyzed before 10 days. Therefore, cells which remained in good condition 10 days in sea water after having been in the test solutions were considered not to have been irreversibly injured. In all of the experiments represented in Figure 1, the plants apparently suffered no permanent injury when allowed to remain in the solutions one hour before being transferred to sea water. All the cells survived at least 10 days and some almost 1 month.

Some of the plants which had been in the bicarbonate solutions for one hour and were then transferred to sea water, were tested after six days to determine whether the sap still had the same pH that it had when the cells were replaced in sea water. It was found that the pH had returned to normal. This appears to have been due to an exosmosis of ions, but a study of this point has been left for future investigation.

It was thought that perhaps the pH 8.0 was responsible for the rapid entrance of basic ions in the case of K and Na bicarbonates rather

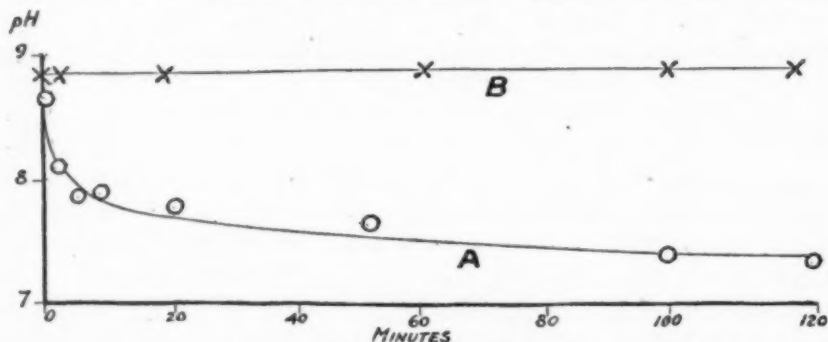


FIG. 2.—Rate of penetration of free CO_2 into the sap of dead cells (curve "A") and the basicity of the sap when the free CO_2 has been removed (curve "B").

than pH 7.0, that of sea water containing CO_2 . For this reason, to the solutions containing K and Na-bicarbonates CO_2 was added until pH 7.0 was obtained. The results were as follows: Cell-sap of plants attained a pH of 5.2 (with CO_2) and a gradual alkalinity of the CO_2 -free sap which was slower in rate of attaining a higher alkalinity than when pH 8.0 was used. It would seem from these data that much CO_2 present hinders the entrance of basic ions into the interior of the cell, or that a more alkaline reaction of the surrounding medium is more favorable to the entrance of certain basic ions.

Figure 2 shows the effects of placing dead cells in sea water containing CO_2 and having a pH of 6.8 to 7.0. The pH of the sap, which was originally 8.6, drops to 7.4 in 30 minutes (curve "A"). When the CO_2 is removed, it is found that the sap has a pH of 8.8 (which is the same as that of the surrounding medium without CO_2). Its basicity is unaltered (curve "B"). Therefore, the initial increase

in the acidity of the cell sap of living plants above that of the surrounding medium, observed under the same conditions, is due to some property inherent in the living condition.

When dead cells are placed in a solution of KHCO_3 or NaHCO_3 of the same concentration used for living cells, the pH of the sap (containing free CO_2) becomes that of the surrounding solution (7.8). When the CO_2 has been removed, the pH of the sap is 8.8 to 9.0 (that of the surrounding medium without CO_2). This process is similar to that which occurs in the case of dead cells placed in sea water containing CO_2 (Fig. 2).

When living cells are placed in any of the sea-water solutions containing CO_2 or bicarbonates, there is apparently a membrane hydrolysis which results in the penetration of H_2CO_3 , to which protoplasm is easily permeable, in advance of KOH or NaOH , which are retarded presumably by the cation. Subsequent slow penetration of these alkalis brings the pH of the cell sap to that which it would have become had the salt itself penetrated as such.

In the case of dead cells, the fact that the H-ion concentration of the sap never exceeds that of the surrounding solution may be due to the fact that basic ions can penetrate freely into dead cells, so that no membrane hydrolysis occurs; or it might possibly be due in part to the fact that there is more available base present in the sap of dead cells than in that of living cells; since the amounts of acid which must be added to sap from living and dead cells to produce a given change of the pH is less in the case of the former than in the latter.

Jacobs (2) noted the increased acidity produced in cells exposed to solutions containing CO_2 , but failed to detect such a change in cells placed in solutions not enriched with free CO_2 . He used three solutions, one containing free CO_2 in distilled water, one containing free CO_2 in a 0.5 M solution of NaHCO_3 , and one a 0.5 M solution of NaHCO_3 . The cells used were the petals of *Symphytum peregrinum*, which are blue when alkaline and pink when acid. When they were placed in either of the first two solutions they became pink, but in the third they turned gradually greenish. This latter reaction was interpreted as being due to the action of alkali. In the experiments of the writer, CO_2 penetrates from a solution of NaHCO_3 in sea water.

No free CO_2 had been added to this solution, but owing to the presence of bicarbonates, a certain amount of this was present. Evidently the indicator of the plant used by Jacobs was not sensitive to changes in pH over the whole necessary range and, therefore, under the conditions just described, it gave no evidence of the penetration of the acid. It would be of interest to know the pH range over which this indicator is sensitive. In the experiments of the writer, the increased

acidity due to penetration of CO_2 is followed by an increase of alkalinity. Perhaps the green coloration of the petals of *Symphytum* observed by Jacobs was also due to increased alkalinity following a stage of increased acidity which was due to penetration of CO_2 , but which was too slight to affect the color of the natural indicator.

It will be noted that the pH of CO_2 -free sap of living cells increased in all the solutions in the above experiments. The question arises as to whether the alkaline ions which are presumably responsible for this effect are normally able to penetrate the cell or whether the existence of abnormally high H or HCO_3 concentration in the cell sap is capable of increasing the permeability of the cell to alkalies.

TABLE I.—*The effects of several anions upon the rate of change in pH of the CO_2 -free sap of Valonia when K and Na are used.*

[The pH of each solution is 6.8 to 7.0. All cells lived more than 10 days when transferred from these solutions to sea water.]

Substance (.03 M) in sea water.....	pH of CO_2 -free sap after having been in solution indicated length of time.					
	10 minutes.	20 minutes.	40 minutes.	60 minutes.	120 minutes.	3 hours.
NaHCO_3	7.0	7.4	7.5	7.6	.....	8.4
KHCO_3	7.2	7.5	7.7	8.0	.....	8.8
Li carbonate.....	.....	.....	7.4	7.7	8.0	.....
Na citrate.....	6.8	6.8	7.2	7.2	.....	7.4
K citrate.....	6.8	7.4	7.4	7.4	.....	7.5
Na acetate.....	6.8	6.8	6.8	6.6	.....	6.6
K acetate.....	6.8	6.8	6.8	7.2	.....	7.5
Na chloride.....	6.8	.....	.....	.....	7.0	7.0
K chloride.....	6.8	.....	.....	.....	7.2	7.2

To obtain more light on this subject, plants were placed in equimolecular solutions (0.03) of K and Na as follows: citrate, acetate and chloride. Table I shows the results. In every case there is a more rapid increase in the degree of alkalinity in the CO_2 -free sap in the case of K than of Na; but none of the substances studied produces so great a degree of alkalinity as do the bicarbonates. It seems, therefore, that the free CO_2 has some influence upon the rate of penetration of these two substances. The fact that CO_2 penetrates the cell more rapidly from KHCO_3 containing solutions than from those containing NaHCO_3 shows that under these conditions the cation affects the permeability of the protoplasm to either itself or to other ions. The same considerations show that the increase in alkalinity of the CO_2 -free sap may be due either to a selective permeability of the protoplasm, to potassium ions, or to an effect of the increased proportion of potassium upon the permeability of the cell to incoming basic or outgoing acidic ions.

Further experiments on cells placed in solutions of NaOH, KOH, or NH_4OH in sea water do show that only the last is capable of penetrating in an appreciable time. The pH of the solutions was in each case 10.0 to 11.5.

These studies may be significant as clues to an explanation of the excessive proportion of K over Na in the sap of *Valonia*. Further experiments are in progress which may throw more light upon the relative importance of the different ions affecting the permeability of *Valonia*.

SUMMARY.

Living cells of *Valonia ventricosa* are exceedingly permeable to carbonic acid. When they are placed in sea water containing alkali bicarbonates, a membrane hydrolysis occurs, carbonic acid entering the cell rapidly. At the same time there is an increase in the alkalinity of sap freed from CO_2 , presumably due to the penetration of alkali ions. The addition of KHCO_3 to sea water makes both the entrance of carbonic acid and the increase in alkalinity more rapid than does the addition of NaHCO_3 . The potassium ion therefore affects the permeability of the protoplasm to the potassium ion or to other ions. These processes do not occur in dead plants.

Other anions studied, citrate, acetate, and chloride, do not produce so great an increase in the alkalinity of the CO_2 -free sap, but also show the greater influence of the K-ion over Na in producing this alkalinity.

Acknowledgments.—The writer takes pleasure in acknowledging the courtesies afforded by the Miami Aquarium Association, where this work was done, and in expressing much gratitude to the authorities of the Carnegie Institution of Washington, D. C., who made arrangements for collecting the plants.

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INCIDENCE OF VENEREAL DISEASES AMONG AMERICAN SEAMEN IN THE ORIENT.

By M. R. KING, Assistant Surgeon, United States Public Health Service.

Opportunity for the study of health conditions among American seamen in the Orient is especially favorable in the port of Manila, P. I., since this is the only station which furnishes both out-patient and hospital relief in this region. The out-patient relief station is maintained as an integral part of the quarantine office, whereas patients needing hospital care are sent to St. Paul's Hospital in Manila,

which is under contract to care for beneficiaries of the Public Health Service.

Of all disabilities encountered in the station of Manila, P. I., venereal diseases predominate. Approximately one patient out of every three who reports for treatment, is afflicted with venereal disease.¹ The out-patient record cards on file show a total of 1,246 patients treated for various disabilities during the period October 23, 1920, to February 12, 1923, 36 per cent of whom were treated for venereal diseases. The in-patient cards show a total of 526 patients sent to the hospital during the above period, 30.4 per cent of whom were hospitalized for venereal diseases.

The number of days spent in the hospital for various disabilities was found to be greater for venereal diseases than for any other class of disability. All patients sent to the hospital during the period considered above consumed a total of 9,306 hospital days, 41.28 per cent of which were spent for venereal diseases. The accompanying table and graph, illustrating the relation of the above figures, are self-explanatory.

Percentage of total cases admitted to hospital and of hospital days on account of various classified disabilities.

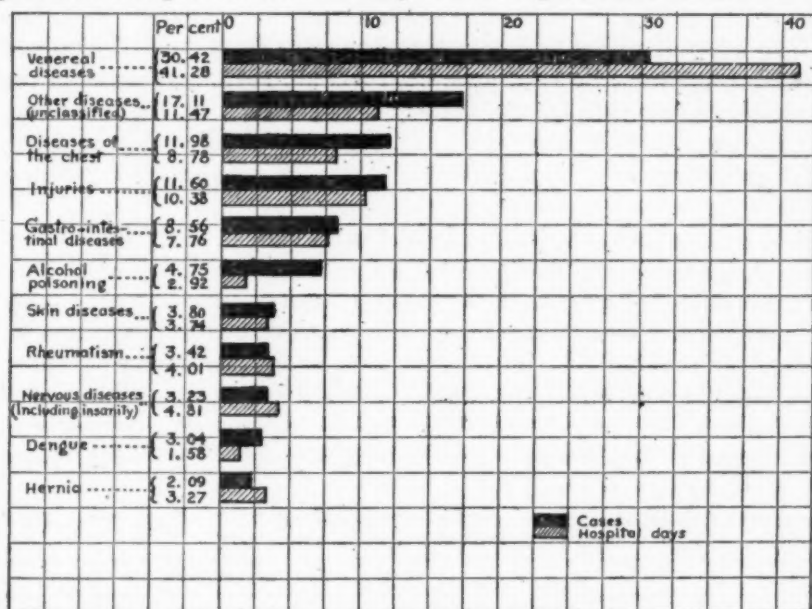
Disability.	Number of cases admitted to hospital.	Number of days in hospital.	Percentage of total cases.	Percentage of total days.
Hernia.....	11	304	2.09	3.27
Dengue.....	16	147	3.04	1.58
Nervous diseases (including insanity).....	17	448	3.23	4.81
Rheumatism.....	18	373	3.42	4.01
Skin diseases.....	20	348	3.80	3.74
Alcohol poisoning.....	25	272	4.75	2.92
Gastro-intestinal diseases.....	45	722	8.56	7.76
Injuries.....	61	966	11.60	10.38
Diseases of the chest.....	63	817	11.98	8.78
Other diseases (unclassified).....	90	1,067	17.11	11.47
Venereal diseases.....	160	3,842	30.42	41.28
Total.....	526	9,306	100.00	100.00

One noteworthy factor is the greater percentage of chancroidal disease at this station as compared with this type of venereal disease reported in continental United States. Although the majority of cases of venereal ulcers were subjected to a Wassermann reaction, undoubtedly some errors in diagnosis have been made, owing to the early stage of most of the cases. However, even if considerable allowance is made for mistakes in diagnosis between syphilis and chancroid, the greater prevalence of the latter is marked. The annual report of the Surgeon General of the United States Public

¹ Venereal diseases constitute one-third of all cases of disease among sailors in the port of Hamburg, Germany, according to the returns of the Hamburg port medical officer (PUBLIC HEALTH REPORTS, May 25, 1923, p. 1141).—Editor.

Health Service for the fiscal year 1922 shows that the reports of cases of venereal diseases received from the State boards of health totaled 333,718 for the year ended June 30, 1922, of which number 2.68 per cent were chancroid, 51.18 per cent syphilis, and 45.80 per cent gonorrhea. Out of the total of 606 venereal cases considered here, 30.37 per cent were chancroid, 12.38 per cent syphilis, and 57.27 per cent gonorrhea. A comparison of these figures shows 27.69 per hundred more cases of chancroid and 38.80 per hundred fewer cases of syphilis in this district.

One of the main causes of the increase in the number of venereal disease cases among American seamen is the unrestricted and marked prevalence of prostitution in many of the seaport cities of the Orient.



Graphic representation of percentage of total cases and hospital days due to various classified disabilities.

The majority of our patients have acquired their infection in Japanese and Chinese seaports, and by the time Manila is reached the disease has secured a firm foothold and is acute and virulent in nature, with frequent complications. By direct inquiry it was learned that solicitation is practiced on the streets in the cities of the Orient; also that it is not an unusual thing for a rickshaw man, on his own initiative, to carry a stranger to a house of ill repute when out sight-seeing. Many of the seamen confessed to being intoxicated at time of infection. The prevalence of chancroidal disease may be associated with greater personal filthiness in oriental ports. Chancroid is more easily prevented by simple cleanliness than gonorrhea or syphilis. The fact that many of the cases run a very severe

course may be due not only to the lack of care at the onset of the disease, but also to the increase in virulence that the organisms acquire by transmission from one host to another of different races.

No specific remedy for the above situation seems to be at hand. Education of seamen as to the danger present in this region and to the value of proper and early prophylactic measures are essential. Many of our cases give a history of having been infected on one or more previous occasions, and so the lesson learned from the first infection seems to be of little value.

DEATH RATES IN A GROUP OF INSURED PERSONS.

COMPARISON OF DEATH RATES FOR PRINCIPAL CAUSES, MARCH AND APRIL, 1923, AND APRIL AND YEAR, 1922.

The accompanying table is taken from the Statistical Bulletin of the Metropolitan Life Insurance Co. for May, 1923, and presents the mortality experience of the industrial department of the company for the months of March and April, 1923, and April and year, 1922. The rates are based on a strength of approximately 14,500,000 insured persons.

The gross death rate for April (10.1 per 1,000) in this group of persons shows a seasonal decline from the rate for March (12 per 1,000), but was slightly higher than the rate for April of 1922 (9.7 per 1,000). The largest declines from rates for the previous month are shown for influenza, tuberculosis, pneumonia and other respiratory diseases, and organic diseases of the heart. High death rates still obtained for measles and whooping cough. The widespread prevalence of measles gives that disease a prominent place in the morbidity record so far this year.

Death rates (annual basis) for principal causes of death per 100,000 lives exposed, March and April, 1923, and April and year, 1922.

Cause of death.	Death rate per 100,000 lives exposed.			
	April, 1923.	March, 1923.	April, 1922.	Year 1922. ¹
Total, all causes.....	1,008.4	1,199.4	909.4	877.2
Typhoid fever.....	3.9	3.3	3.6	5.6
Measles.....	12.5	13.6	7.6	4.3
Scarlet fever.....	6.5	6.9	5.9	4.8
Whooping cough.....	6.8	7.3	2.1	2.6
Diphtheria.....	12.3	18.2	12.7	17.8
Influenza.....	47.7	100.4	41.1	21.5
Tuberculosis (all forms).....	119.0	124.2	124.8	113.4
Tuberculosis of respiratory system.....	109.0	114.8	113.9	102.9
Cancer.....	74.6	74.2	66.8	71.5
Diabetes mellitus.....	21.3	22.0	(²)	17.0
Cerebral hemorrhage.....	65.9	72.9	66.8	62.4
Organic diseases of heart.....	139.3	174.6	142.3	126.0
Pneumonia (all forms).....	108.2	164.3	102.4	73.3
Other respiratory diseases.....	15.7	23.8	15.0	13.6
Diarrhea and enteritis.....	8.7	5.2	5.5	10.7
Bright's disease (chronic nephritis).....	78.3	88.2	74.8	60.9
Puerperal state.....	18.0	19.1	18.3	18.9
Suicides.....	7.0	7.0	9.0	7.4
Homicides.....	6.6	5.9	4.2	6.2
Other external causes(excluding suicides and homicides)	55.1	54.6	45.0	57.7
Traumatism by automobile.....	11.0	7.8	8.8	13.5
All other causes.....	201.1	213.7	221.8	172.6

¹ Based on provisional estimate of lives exposed to risk in 1922.

² Not available.

DEATHS DURING WEEK ENDED JUNE 16, 1923.

Summary of information received by telegraph from industrial insurance companies for week ended June 16, 1923, and corresponding week of 1922. (From the Weekly Health Index, June 19, 1923, issued by the Bureau of the Census, Department of Commerce.)

	Week ended June 16, 1923.	Corresponding week, 1922.
Policies in force.....	49, 178, 986	50, 058, 107
Number of death claims.....	9, 632	8, 289
Death claims per 1,000 policies in force, annual rate.....	10.2	8.6

Deaths from all causes in certain large cities of the United States during the week ended June 16, 1923, infant mortality, annual death rate, and comparison with corresponding week of 1922. (From the Weekly Health Index, June 19, 1923, issued by the Bureau of the Census, Department of Commerce.)

City.	Week ended June 16, 1923.		Annual death rate per 1,000, corre- sponding week, 1922.	Deaths under 1 year.		Infant mor- tality rate, week ended June 16, 1923. ²
	Total deaths.	Death rate. ¹		Week ended June 16, 1923.	Corre- sponding week, 1922.	
Total.....	6,298	11.3	11.4	805	762	.....
Akron, Ohio.....	27	6.8	7.5	3	5	36
Albany, N. Y. ³	22	9.8	12.6	2	4	44
Atlanta, Ga.....	82	19.2	13.7	14	11	.....
Baltimore, Md. ²	193	13.0	13.5	27	26	79
Birmingham, Ala.....	68	18.1	16.4	7	9	.....
Boston, Mass.....	187	12.7	14.0	27	19	77
Bridgeport, Conn.....	26	9.4	11.3	2	4	28
Buffalo, N. Y.....	113	11.0	10.7	24	19	101
Cambridge, Mass.....	29	13.6	13.6	5	4	80
Camden, N. J. ³	21	8.8	13.7	1	2	17
Chicago, Ill.....	582	10.5	10.3	69	85	.....
Cincinnati, Ohio.....	115	14.8	12.5	15	12	99
Cleveland, Ohio ²	148	8.7	10.2	21	25	58
Columbus, Ohio.....	57	11.4	13.0	5	4	52
Dallas, Tex.....	39	11.5	11.2	10	4	.....
Dayton, Ohio.....	34	10.7	10.3	5	1	82
Denver, Colo.....	76	14.6	13.8	8	6	.....
Des Moines, Iowa.....	33	12.2	.....	2	.....	.....
Detroit, Mich.....	233	12.2	9.4	43	30	86
Duluth, Minn.....	17	8.3	.....	0	.....	0
Erie, Pa.....	22	10.2	5.7	2	4	41
Fall River, Mass.....	30	12.9	10.8	9	3	128
Flint, Mich.....	24	10.6	.....	6	.....	119
Fort Worth, Tex.....	31	11.2	11.4	8	3	.....
Grand Rapids, Mich.....	27	9.6	8.0	3	3	47
Houston, Tex.....	29	9.8	15.3	4	1	.....
Indianapolis, Ind.....	87	13.2	10.7	13	10	100
Jacksonville, Fla.....	36	18.8	18.7	3	1	.....
Kansas City, Kans.....	24	10.8	8.7	2	2	46
Kansas City, Mo.....	81	12.0	15.0	9	10	.....
Los Angeles, Calif.....	180	14.1	15.8	25	20	94
Louisville, Ky.....	63	12.7	11.0	9	6	97
Lowell, Mass.....	33	15.0	6.4	2	5	35
Memphis, Tenn.....	38	11.7	22.4	5	5	.....
Milwaukee, Wis.....	104	11.2	8.3	13	12	65
Minneapolis, Minn.....	68	8.7	9.8	6	7	33
Nashville, Tenn. ²	29	12.5	11.7	7	7	.....
New Bedford, Mass.....	26	10.4	11.0	3	8	47
New Haven, Conn.....	29	8.7	8.3	5	2	65
New Orleans, La.....	126	16.2	17.9	16	9	.....
New York, N. Y.....	1,166	10.3	11.2	138	164	55
Bronx Borough.....	126	7.8	10.1	4	13	14
Brooklyn Borough.....	391	9.5	9.5	48	58	51
Manhattan Borough.....	537	12.4	13.4	76	78	74
Queens Borough.....	74	7.2	9.1	5	14	27
Richmond Borough.....	38	15.5	16.3	5	1	91

¹ Annual rate per 1,000 population.

² Deaths under 1 year per 1,000 births—an annual rate based on deaths under 1 year for the week and estimated births for 1922. Cities left blank are not in the registration area for births.

³ Deaths for week ended Friday, June 15, 1923.

Deaths from all causes in certain large cities of the United States during the week ended June 16, 1923, infant mortality, annual death rate, and comparison with corresponding week of 1922. (From the Weekly Health Index, June 19, 1923, issued by the Bureau of the Census, Department of Commerce.)—Continued.

City.	Week ended June 16, 1923.		Annual death rate per 1,000, corre- sponding week, 1922.	Deaths under 1 year.		Infant mor- tality rate, week ended June 16, 1923.
	Total deaths.	Death rate.		Week ended June 16, 1923.	Corre- sponding week, 1922.	
Newark, N. J.	83	9.9	10.5	17	16	80
Norfolk, Va.	25	8.2	9.2	7	5	123
Oakland, Calif.	44	9.6	8.9	4	1	51
Omaha, Neb.	32	8.2	15.3	0	7	0
Paterson, N. J.	34	12.7	13.2	4	4	64
Philadelphia, Pa.	430	11.7	11.6	37	49	48
Pittsburgh, Pa.	159	13.5	11.3	27	16	94
Portland, Oreg.	56	10.7	9.5	5	3	51
Providence, R. I.	63	13.6	10.8	5	10	41
Richmond, Va.	61	17.6	12.3	13	6	159
Rochester, N. Y.	66	10.8	9.4	8	6	63
St. Louis, Mo.	170	11.0	11.8	12	11	.....
St. Paul, Minn.	49	10.6	9.6	5	10	46
Salt Lake City, Utah ¹	35	14.5	10.5	6	4	98
San Antonio, Texas.	40	11.3	.....	9	.....	.....
San Francisco, Calif.	112	10.8	11.5	6	14	36
Seattle, Wash.	55	9.1	9.3	3	3	27
Spokane, Wash.	24	12.0	12.0	1	1	22
Springfield, Mass.	36	13.0	7.1	3	1	43
Syracuse, N. Y.	41	11.6	13.0	5	7	65
Tacoma, Wash.	23	11.8	.....	2	.....	50
Toledo, Ohio.	55	10.7	9.6	13	9	131
Trenton, N. J.	33	13.5	13.3	6	1	102
Utica, N. Y.	17	8.6	.....	2	.....	42
Washington, D. C.	92	11.0	12.2	11	12	63
Wilmington, Del.	23	10.2	10.4	2	3	41
Worcester, Mass.	33	9.0	9.4	5	8	57
Yonkers, N. Y.	15	7.3	10.4	5	2	108
Youngton, Ohio.	37	14.6	9.5	4	1	54

¹ Deaths for week ended Friday June 15, 1923.

PREVALENCE OF DISEASE.

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring.

UNITED STATES.

CURRENT STATE SUMMARIES.

These reports are preliminary, and the figures are subject to change when later returns are received by the State health officers.

Reports for Week Ended June 23, 1923.

ALABAMA.		CALIFORNIA.	
	Cases.		Cases.
Chicken pox.....	8	Cerebrospinal meningitis—Redding.....	1
Diphtheria.....	5	Diphtheria.....	121
Dysentery.....	207	Influenza.....	15
Influenza.....	20	Lethargic encephalitis:	
Malaria.....	74	Grass Valley.....	1
Measles.....	585	San Francisco.....	2
Mumps.....	11	Measles.....	490
Pellagra.....	17	Rabies in man—Los Angeles.....	1
Pneumonia.....	12	Scarlet fever.....	108
Scarlet fever.....	8	Smallpox.....	20
Tuberculosis.....	47	Typhoid fever.....	9
Typhoid fever.....	55		
Whooping cough.....	64		
ARIZONA.		COLORADO.	
		(Exclusive of Denver.)	
Chicken pox.....	6	Chicken pox.....	5
Diphtheria.....	5	Diphtheria.....	13
Measles.....	10	Measles.....	80
Pneumonia.....	1	Mumps.....	7
Scarlet fever.....	7	Scarlet fever.....	4
Typhoid fever.....	4	Tuberculosis.....	110
		Typhoid fever.....	6
		Whooping cough.....	5
ARKANSAS.		CONNECTICUT.	
Chicken pox.....	4	Chicken pox.....	22
Diphtheria.....	5	Diphtheria.....	32
Hookworm disease.....	1	Dysentery (bacillary).....	1
Influenza.....	12	German measles.....	10
Malaria.....	150	Lethargic encephalitis.....	2
Measles.....	83	Malaria.....	2
Mumps.....	5	Measles.....	89
Pellagra.....	20	Mumps.....	9
Smallpox.....	5	Pneumonia (lobar).....	6
Tuberculosis.....	9	Scarlet fever.....	64
Typhoid fever.....	8	Tetanus.....	1
Whooping cough.....	30		

CONNECTICUT—continued.

	Cases.
Tuberculosis (all forms).....	36
Whooping cough.....	46

DELAWARE.

Chicken pox.....	2
Diphtheria.....	6
Measles.....	6
Pneumonia.....	4
Scarlet fever.....	5
Tuberculosis.....	3
Typhoid fever.....	1
Whooping cough.....	4

DISTRICT OF COLUMBIA.

Chicken pox.....	18
Diphtheria.....	6
Measles.....	63
Scarlet fever.....	14
Tuberculosis.....	10
Typhoid fever.....	4
Whooping cough.....	23

FLORIDA.

Cerebrospinal meningitis.....	2
Dengue.....	1
Diphtheria.....	8
Influenza.....	20
Leprosy.....	1
Malaria.....	32
Ophthalmia neonatorum.....	1
Pneumonia.....	66
Scarlet fever.....	1
Smallpox.....	7
Typhoid fever.....	21

GEORGIA.

Chicken pox.....	7
Diphtheria.....	3
Dysentery (amebic).....	1
Dysentery (bacillary).....	7
Hookworm disease.....	20
Influenza.....	7
Malaria.....	23
Measles.....	124
Mumps.....	5
Pneumonia.....	11
Scarlet fever.....	7
Septic sore throat.....	1
Smallpox.....	9
Trachoma.....	1
Tuberculosis (pulmonary).....	9
Typhoid fever.....	22
Whooping cough.....	16

ILLINOIS.

Cerebrospinal meningitis—Cook County.....	2
Diphtheria:	
Cook County (including Chicago).....	96
Chicago.....	80
Scattering.....	26
Influenza.....	4
Lethargic encephalitis:	
Grundy County.....	1
La Salle County.....	1
Pneumonia.....	116

¹ Week ended Friday.

ILLINOIS—continued.

Poliomyelitis:	Cases.
Cumberland County.....	1
Fulton County.....	1
Scarlet fever:	
Cook County (including Chicago).....	69
Chicago.....	61
Scattering.....	36
Smallpox:	
Cook County (including Chicago).....	6
Chicago.....	5
Kane County.....	18
Scattering.....	29
Typhoid fever.....	24
Whooping cough.....	198

INDIANA.

Diphtheria.....	20
Measles.....	462
Scarlet fever.....	25
Smallpox.....	40
Tuberculosis.....	42
Typhoid fever.....	17

IOWA.

Diphtheria.....	8
Scarlet fever.....	21
Smallpox.....	17
Typhoid fever.....	2

KANSAS.

Chicken pox.....	20
Diphtheria.....	19
German measles.....	3
Measles.....	371
Mumps.....	20
Pneumonia.....	4
Scarlet fever.....	20
Smallpox.....	8
Tuberculosis.....	53
Typhoid fever.....	8
Whooping cough.....	45

LOUISIANA.

Diphtheria.....	13
Influenza.....	1
Measles.....	90
Scarlet fever.....	1
Smallpox.....	3
Typhoid fever.....	35
Whooping cough.....	12

MAINE.

Chicken pox.....	14
Diphtheria.....	8
German measles.....	12
Measles.....	130
Pneumonia.....	4
Scarlet fever.....	17
Tuberculosis.....	7
Typhoid fever.....	4
Whooping cough.....	10

MARYLAND.¹

Cerebrospinal meningitis.....	1
Chicken pox.....	51
Diphtheria.....	24

MARYLAND—continued.

	Cases.
Dysentery.....	1
German measles.....	4
Influenza.....	6
Malaria.....	3
Measles.....	370
Mumps.....	26
Paratyphoid fever.....	1
Pneumonia (all forms).....	41
Scarlet fever.....	68
Septic sore throat.....	5
Tetanus.....	1
Tuberculosis.....	61
Typhoid fever.....	14
Whooping cough.....	111

MASSACHUSETTS.

Cerebrospinal meningitis.....	2
Chicken pox.....	147
Conjunctivitis (suppurative).....	13
Diphtheria.....	130
German measles.....	7
Influenza.....	5
Lethargic encephalitis.....	1
Measles.....	536
Mumps.....	125
Ophthalmia neonatorum.....	14
Pneumonia (lobar).....	22
Poliomyelitis.....	2
Scarlet fever.....	232
Septic sore throat.....	1
Tetanus.....	1
Tuberculosis (all forms).....	129
Typhoid fever.....	9
Whooping cough.....	105

MICHIGAN.

Diphtheria.....	98
Measles.....	1,788
Pneumonia.....	96
Scarlet fever.....	192
Smallpox.....	19
Tuberculosis.....	65
Typhoid fever.....	9
Whooping cough.....	211

MINNESOTA.

Chicken pox.....	7
Diphtheria.....	47
Lethargic encephalitis.....	1
Measles.....	201
Pneumonia.....	2
Scarlet fever.....	82
Smallpox.....	5
Trachoma.....	7
Tuberculosis.....	50
Typhoid fever.....	12
Whooping cough.....	15

MISSISSIPPI.

Diphtheria.....	1
Influenza.....	7
Poliomyelitis.....	1
Smallpox.....	3
Typhoid fever.....	18

MISSOURI.

(Exclusive of Kansas City.)

	Cases.
Cerebrospinal meningitis.....	1
Chicken pox.....	10
Diphtheria.....	27
Measles.....	247
Mumps.....	7
Scarlet fever.....	25
Smallpox.....	9
Trachoma.....	1
Tuberculosis.....	46
Typhoid fever.....	12
Whooping cough.....	160

MONTANA.

Diphtheria.....	2
Rocky Mountain spotted fever:	
Jordan.....	1
Fingerbutte.....	1
Scarlet fever.....	18
Smallpox.....	6
Typhoid fever.....	1

NEBRASKA.

Chicken pox.....	4
Diphtheria.....	19
Measles.....	17
Mumps.....	5
Poliomyelitis.....	1
Scarlet fever.....	8
Tuberculosis.....	1
Typhoid fever.....	1
Whooping cough.....	22

NEW JERSEY.

Cerebrospinal meningitis.....	1
Chicken pox.....	151
Diphtheria.....	76
Dysentery.....	2
Measles.....	499
Pneumonia.....	44
Poliomyelitis.....	1
Scarlet fever.....	84
Smallpox.....	1
Typhoid fever.....	26
Whooping cough.....	96

NEW MEXICO.

Diphtheria.....	23
Measles.....	21
Pneumonia.....	2
Scarlet fever.....	2
Tuberculosis.....	20
Typhoid fever.....	2

NEW YORK.

(Exclusive of New York City.)

Cerebrospinal meningitis.....	4
Diphtheria.....	103
Influenza.....	1
Lethargic encephalitis.....	1
Measles.....	2,013
Pneumonia.....	127
Poliomyelitis.....	3

NEW YORK—continued.		VERMONT.	
	Cases.		Cases.
Scarlet fever.....	198	Chicken pox.....	3
Smallpox.....	4	Diphtheria.....	3
Typhoid fever.....	15	Measles.....	89
Whooping cough.....	166	Mumps.....	21
		Pneumonia.....	2
		Scarlet fever.....	4
		Smallpox.....	2
		Whooping cough.....	15
NORTH CAROLINA.		VIRGINIA.	
Cerebrospinal meningitis.....	3		
Chicken pox.....	41	Smallpox—Tazewell County.....	1
Diphtheria.....	13		
German measles.....	2	WASHINGTON.	
Measles.....	1,064	Chicken pox.....	32
Ophthalmia neonatorum.....	1	Diphtheria.....	15
Scarlet fever.....	11	Measles.....	64
Septic sore throat.....	3	Mumps.....	9
Smallpox.....	50	Scarlet fever.....	17
Trachoma.....	5	Smallpox:	
Typhoid fever.....	37	Clark County.....	16
Whooping cough.....	371	Scattering.....	19
		Tuberculosis.....	51
		Typhoid fever.....	6
		Whooping cough.....	90
OREGON.		WEST VIRGINIA.	
Chicken pox.....	19	Scarlet fever.....	4
Diphtheria.....	13	Smallpox.....	1
Measles.....	5	Typhoid fever.....	8
Mumps.....	2		
Pneumonia.....	14	WISCONSIN.	
Scarlet fever.....	17	Milwaukee:	
Smallpox:		Chicken pox.....	13
Portland.....	10	Diphtheria.....	10
Scattering.....	4	Lethargic encephalitis.....	1
Tuberculosis.....	4	Measles.....	28
Typhoid fever.....	4	Pneumonia.....	4
Whooping cough.....	11	Scarlet fever.....	73
		Tuberculosis.....	16
		Whooping cough.....	33
SOUTH DAKOTA.		Scattering:	
Chicken pox.....	13	Chicken pox.....	44
Diphtheria.....	9	Diphtheria.....	29
Measles.....	106	Influenza.....	8
Scarlet fever.....	8	Measles.....	808
Tuberculosis.....	2	Pneumonia.....	6
Whooping cough.....	1	Polio-myelitis.....	1
		Scarlet fever.....	137
		Smallpox.....	34
		Tuberculosis.....	39
		Typhoid fever.....	3
		Whooping cough.....	77
TEXAS.		WYOMING.	
Anthrax.....	1	Chicken pox.....	2
Chicken pox.....	5	Measles.....	27
Diphtheria.....	10	Rocky Mountain spotted fever.....	5
Dysentery.....	2	Typhoid fever.....	1
Influenza.....	5		
Measles.....	23		
Mumps.....	1		
Pellagra.....	1		
Pneumonia.....	2		
Polio-myelitis.....	1		
Scarlet fever.....	2		
Smallpox.....	26		
Tuberculosis.....	15		
Typhoid fever.....	12		
Whooping cough.....	69		

¹ Deaths.

Reports for Week Ended June 16, 1923.

DISTRICT OF COLUMBIA.		NORTH DAKOTA.	
	Cases.		Cases.
Chicken pox.....	20	Chicken pox.....	12
Diphtheria.....	4	Diphtheria.....	8
Measles.....	104	Measles.....	30
Scarlet fever.....	11	Pneumonia.....	1
Tuberculosis.....	10	Scarlet fever.....	5
Typhoid fever.....	1	Smallpox.....	2
Whooping cough.....	18	Tuberculosis.....	5
		Whooping cough.....	19

SUMMARY OF CASES REPORTED MONTHLY BY STATES.

The following summary of monthly State reports is published weekly and covers only those States from which reports are received during the current week:

State.	Cerebrospinal meningitis.	Diphtheria.	Influenza.	Malaria.	Measles.	Pellagra.	Poliomyelitis.	Scarlet fever.	Smallpox.	Typhoid fever.
<i>May, 1923.</i>										
Arizona.....		20			163			68	6	8
Illinois.....	9	678	110	4	12,049		5	739	67	54
Indiana.....	8	162	19		5,421		1	271	243	14
Louisiana.....	2	53	66	58	345	36	2	12	80	64
Maryland.....	1	140	69	22	4,419		1	678		35
Michigan.....		300		1	8,237			1,130	91	35
Minnesota.....	5	240	8		3,741		2	707	117	21
New York.....	27	1,234	188	17	13,646		17	2,308	20	122
Rhode Island.....	3	56	3		487			96		3
South Carolina.....	1	74		17	386	2		7	23	26

RECIPROCAL NOTIFICATION.

May, 1923.

Cases of communicable diseases referred during May, 1923, to other State health departments by departments of health of certain States.

State referred by.	Diphtheria.	Dysentery.	Lethargic encephalitis.	Measles.	Poliomyelitis.	Smallpox.	Tuberculosis.	Typhoid fever.
Connecticut.....	1	1		1				2
Illinois.....								2
Louisiana.....	1				1		9	
Massachusetts.....								3
Minnesota.....			1				38	3
New Jersey.....								1
New York.....				2		1		2
Washington.....								1

CITY REPORTS FOR WEEK ENDED JUNE 9, 1923.

ANTHRAX.

City.	Cases.	Deaths.
Illinois:		
Chicago.....	1	1

CITY REPORTS FOR WEEK ENDED JUNE 9, 1923—Continued.

CEREBROSPINAL MENINGITIS.

The column headed "Median for previous years" gives the median number of cases reported during the corresponding week of the years 1915 and 1922, inclusive. In instances in which data for the full eight years are incomplete, the median is that for the number of years for which information is available.

City.	Median for pre- vious years.	Week ended June 9, 1923.		City.	Median for pre- vious years.	Week ended June 9, 1923.	
		Cases.	Deaths.			Cases.	Deaths.
California:				New York:			
San Bernardino.....	0	.....	1	New York.....	7	2	1
Connecticut:				Ohio:			
Bridgeport.....	0	1	1	Cleveland.....	1	1	1
Illinois:				Pennsylvania:			
Chicago.....	2	1	.....	Philadelphia.....	0	1	1
Freeport.....	0	.....	1	Pittsburgh.....	0	1	1
Maine:				Texas:			
Lewiston.....	0	.....	2	Waco.....	0	.....	1
Minnesota:				Virginia:			
Minneapolis.....	0	1	1	Richmond.....	0	1	.....
Missouri:							
St. Louis.....	0	1	2				
New Jersey:							
Harrison.....	0	1	1				
Pasamic.....	0	.....	1				

DIPHTHERIA.

See p. 1494; also Current State summaries, p. 1483, and Monthly summaries by States, p. 1487.

INFLUENZA.

City.	Cases.		Deaths, week ended June 9, 1923.	City.	Cases.		Deaths, week ended June 9, 1923.
	Week ended June 10, 1922.	Week ended June 9, 1923.			Week ended June 10, 1922.	Week ended June 9, 1923.	
Alabama:				Minnesota:			
Birmingham.....	.....	.....	1	Minneapolis.....	.....	.....	1
Mobile.....	.....	.....	1	Missouri:			
California:				Kansas City.....	1	.....	.....
Los Angeles.....	1	3	.....	New Jersey:			
Sacramento.....	.....	.....	1	Newark.....	6	.....	.....
San Diego.....	1	1	1	New York:			
San Francisco.....	4	.....	.....	Jamestown.....	.....	1	.....
Colorado:				New York.....	13	10	4
Denver.....	.....	.....	1	Rochester.....	.....	.....	2
Florida:				Saratoga Springs.....	1	.....	.....
Tampa.....	1	.....	.....	Ohio:			
Illinois:				Akron.....	1	1	.....
Chicago.....	5	2	.....	Lancaster.....	.....	.....	1
Freeport.....	.....	.....	1	Newark.....	.....	.....	1
Louisiana:				Piqua.....	.....	.....	1
New Orleans.....	.....	2	3	Pennsylvania:			
Maryland:				Philadelphia.....	1	1	1
Baltimore.....	.....	3	2	Pittsburgh.....	.....	.....	1
Massachusetts:				Rhode Island:			
Attleboro.....	.....	1	.....	Providence.....	1	.....	.....
Cambridge.....	1	.....	.....	Tennessee:			
Haverhill.....	1	.....	.....	Memphis.....	.....	1	.....
Saugus.....	2	.....	.....	Nashville.....	.....	.....	1
Springfield.....	.....	1	.....	Virginia:			
Michigan:				Roanoke.....	.....	.....	1
Detroit.....	1	.....	1				

CITY REPORTS FOR WEEK ENDED JUNE 9, 1923—Continued.

LEPROSY.

City.	Cases.	Deaths.
California: San Francisco.....	12	.....

¹ Not local.

LETHARGIC ENCEPHALITIS.

California: San Francisco.....	1	1
Nebraska: Omaha.....		1
Oregon: Portland.....		1

MALARIA.

City.	Cases.	Deaths.	City.	Cases.	Deaths.
Alabama: Birmingham.....	1	.....	New Jersey: East Orange.....	1	.....
Mobile.....	1	.....	Hackensack.....	1	.....
Arkansas: Little Rock.....	1	.....	Newark.....	1	.....
Connecticut: Bridgeport.....	1	.....	New York: New York.....	3	.....
Greenwich.....	1	.....	Ohio: Akron.....	1	.....
Florida: Tampa.....	1	.....	South Carolina: Columbia.....		1
Georgia: Savannah.....	1	1	Tennessee: Memphis.....	6	.....
Kentucky: Louisville.....	1	.....	Texas: Beaumont.....		1
Louisiana: New Orleans.....	2	.....	Houston.....		1
Massachusetts: Springfield.....	1	.....		

MEASLES.

See p. 1494; also Current State summaries, p. 1483, and Monthly summaries by States, p. 1487.

PELLAGRA.

City.	Cases.	Deaths.	City.	Cases.	Deaths.
Arkansas: Little Rock.....	1	.....	South Carolina: Columbia.....		2
Georgia: Atlanta.....		1	Tennessee: Memphis.....	1	1
Louisiana: New Orleans.....	1	.....	Virginia: Lynchburg.....		1

PNEUMONIA (ALL FORMS).

Alabama: Anniston.....	18	7	California—Continued. San Diego.....	3	3
Montgomery.....	2	1	San Francisco.....	13	4
California: Glendale.....		1	Santa Ana.....		1
Los Angeles.....	22	11	Vallejo.....		1
Oakland.....	3	4	Colorado: Denver.....		6
Richmond.....	1	1	Connecticut: Bridgeport.....	4	2
Riverside.....	2	2	Hartford.....	3	1
Sacramento.....	3	2	New Haven.....		1
San Bernardino.....	2	1			

CITY REPORTS FOR WEEK ENDED JUNE 9, 1923—Continued.

PNEUMONIA (ALL FORMS)—Continued.

City.	Cases.	Deaths.	City.	Cases.	Deaths.
District of Columbia:			Michigan—Continued.		
Washington.....		19	Detroit.....	81	32
Florida:			Flint.....	6	7
Tampa.....	1	1	Grand Rapids.....	6	4
Georgia:			Hamtramck.....		1
Atlanta.....	8	8	Highland Park.....	3	
Savannah.....	1	1	Kalamazoo.....	2	2
Illinois:			Pontiac.....	4	1
Alton.....	1		Saginaw.....		1
Aurora.....	1		Minnesota:		
Blue Island.....	2	2	Duluth.....	3	
Chicago.....	196	72	Minneapolis.....		1
Evanston.....	1		Missouri:		
Freeport.....	1	1	Kansas City.....	9	5
Galesburg.....	1		St. Joseph.....		3
Oak Park.....		1	Montana:		
Pekin.....	1		Great Falls.....		1
Rock Island.....	1		Missoula.....	2	2
Springfield.....	1	1	Nebraska:		
Indiana:			Omaha.....		1
Anderson.....		2	New Hampshire:		
Gary.....	1	1	Nashua.....		3
Hammond.....	1		New Jersey:		
Indianapolis.....	5		Bloomfield.....	1	
Kokomo.....	1		Clifton.....	2	2
La Fayette.....	3		East Orange.....	3	1
Muncie.....	1	1	Elizabeth.....		4
Iowa:			Garfield.....	1	
Burlington.....	3	1	Harrison.....	2	
Muscatine.....	1		Hoboken.....	2	1
Kansas:			Jersey City.....	2	1
Kansas City.....	1		Kearny.....	29	10
Topeka.....	2	2	Newark.....	2	2
Wichita.....		1	Orange.....	2	2
Kentucky:			Passaic.....	1	1
Henderson.....		1	Phillipsburg.....	5	1
Lexington.....		2	Plainfield.....	2	1
Louisville.....	6	10	Trenton.....	1	
Louisiana:			West New York.....	1	
New Orleans.....	7	7	New Mexico:		
Maine:			Albuquerque.....	1	
Bangor.....	2		New York:		
Bath.....		1	Albany.....	7	
Biddeford.....		1	Amsterdam.....	2	2
Lewiston.....	1	1	Buffalo.....	29	10
Portland.....		2	Cohoes.....	4	2
Maryland:			Geneva.....	1	
Baltimore.....	35	26	Hornes.....	6	2
Massachusetts:			Jamestown.....	4	
Boston.....	14	14	Lackawanna.....	1	
Brockton.....		1	Lockport.....	4	
Brookline.....	1	3	Middletown.....	1	1
Cambridge.....	1	1	Mount Vernon.....	219	130
Chicopee.....	2		New York.....		1
Easthampton.....	1	1	Newburgh.....	6	2
Everett.....	1		Niagara Falls.....		1
Fall River.....	1	1	North Tonawanda.....	1	
Frammingham.....		1	Peekskill.....	39	4
Lowell.....		2	Rochester.....	1	
Lynn.....	1	1	Schenectady.....	9	3
Malden.....	2	1	Syracuse.....	1	1
Medford.....	2	1	Troy.....	4	
Millford.....	3	1	White Plains.....	3	
New Bedford.....		1	Yonkers.....		
Newton.....		1	Ohio:		
North Adams.....		3	Akron.....	4	
Pittsfield.....			Cincinnati.....	39	19
Quincy.....	1	1	Cleveland.....		5
Salem.....	11	1	Columbus.....	1	
Somerville.....		1	Dayton.....		2
Springfield.....		1	Lima.....	1	
Taunton.....		1	Lorain.....	1	1
Wakefield.....	1	1	Mansfield.....		1
Waltham.....		4	New Philadelphia.....		1
Worcester.....			Piqua.....		1
Michigan:			Springfield.....		7
Ann Arbor.....	1		Toledo.....		3
Battle Creek.....	1		Youngstown.....		2
Benton Harbor.....		1	Zanesville.....		

CITY REPORTS FOR WEEK ENDED JUNE 9, 1923—Continued.

PNEUMONIA (ALL FORMS)—Continued.

City.	Cases.	Deaths.	City.	Cases.	Deaths.
Oklahoma:			Utah:		
Oklahoma.....		2	Provo.....	1	
Oregon:			Salt Lake City.....		1
Portland.....		1	Vermont:		
Pennsylvania:			Burlington.....		2
Philadelphia.....	44	39	Rutland.....	1	
Pittsburgh.....		39	Virginia:		
Rhode Island:			Charlottesville.....		1
Pawtucket.....		2	Lynchburg.....		1
Providence.....		6	Norfolk.....	1	2
South Carolina:			Petersburg.....		2
Charleston.....		1	Richmond.....	1	4
Columbia.....		1	Roanoke.....	1	2
South Dakota:			West Virginia:		
Sioux Falls.....		1	Bluefield.....	1	1
Tennessee:			Fairmont.....		2
Memphis.....		4	Huntington.....		2
Nashville.....		2	Wheeling.....		2
Texas:			Wisconsin:		
Beaumont.....		1	Madison.....	1	
El Paso.....		2	Milwaukee.....	7	
Fort Worth.....	1	1	Racine.....	1	
Houston.....		1			
San Antonio.....	1	2			
Waco.....		2			

POLIOMYELITIS (INFANTILE PARALYSIS).

The column headed "Median for previous years" gives the median number of cases reported during the corresponding week of the years 1915 to 1922, inclusive. In instances in which data for the full eight years are incomplete, the median is that for the number of years for which information is available.

City.	Median for pre- vious years.	Week ended June 9, 1923.		City.	Median for pre- vious years.	Week ended June 9, 1923.	
		Cases.	Deaths.			Cases.	Deaths.
Massachusetts:				Ohio:			
Lynn.....	0	1		Youngstown.....	0	1	
New York:				Texas:			
Jamestown.....	0	1		Houston.....	0	3	
New York.....	1	1					

RABIES IN ANIMALS.

City.	Cases.	City.	Cases.
California:		Kentucky:	
Los Angeles.....	13	Louisville.....	2
Georgia:		Missouri:	
Savannah.....	2	Kansas City.....	1

SCARLET FEVER.

See p. 1494; also Current State summaries, p. 1483, and Monthly summaries by States, p. 1487.

CITY REPORTS FOR WEEK ENDED JUNE 9, 1923—Continued.

SMALLPOX.

The column headed "Median for previous years" gives the median number of cases reported during the corresponding week of the years 1915 to 1922, inclusive. In instances in which data for the full eight years are incomplete, the median is that for the number of years for which information is available.

City.	Median for previous years.	Week ended June 9, 1923.		City.	Median for previous years.	Week ended June 9, 1923.	
		Cases.	Deaths.			Cases.	Deaths.
Alabama:				Montana:			
Mobile.....	3	1		Great Falls.....	2	2	
California:				New York:			
Los Angeles.....	1	11		Niagara Falls.....	0	1	
Oakland.....	0	1		North Carolina:			
Georgia:				Greensboro.....	0	3	
Augusta.....	5	2		Raleigh.....	0	3	
Atlanta.....	7	4		Winston-Salem.....	0	5	
Savannah.....	0	1		Ohio:			
Illinois:				Barberton.....	0	1	
Chicago.....	2	3		Chillicothe.....	0	2	
Decatur.....	0	6		Columbus.....	1	1	
Oak Park.....	0	3		Dayton.....	0	4	
Pekin.....	0	3		Middletown.....	0	1	
Springfield.....	1	1		Piqua.....	0	1	
Indiana:				Sandusky.....	0	5	
Anderson.....	1	1		Toledo.....	0	2	
Fort Wayne.....	2	15		Oklahoma:			
Gary.....	0	6		Oklahoma.....	5	5	
Huntington.....	0	6		Tulsa.....	2	8	
Indianapolis.....	14	8		Oregon:			
Logansport.....	0	4		Portland.....	6	9	
Michigan City.....	0	3		Pennsylvania:			
Muncie.....	0	4		Erie.....	0	1	
South Bend.....	0	4		Philadelphia.....	0	1	
Iowa:				Tennessee:			
Council Bluffs.....	1	1		Knoxville.....	1	24	
Davenport.....	3	21		Memphis.....	0	2	
Kansas:				Texas:			
Parsons.....	2	1		Fort Worth.....	3	1	
Wichita.....	7	1		Waco.....	0	1	
Kentucky:				Vermont:			
Owensboro.....	0	2		Barre.....	0	1	
Maine:				Burlington.....	0	1	
Auburn.....	0	1		Virginia:			
Michigan:				Roanoke.....	1	2	
Benton Harbor.....	0	1		Washington:			
Detroit.....	14	1		Seattle.....	3	3	
Highland Park.....	0	1		Spokane.....	4	2	
Holland.....	0	2		Wisconsin:			
Minnesota:				Ashland.....	0	1	
Duluth.....	2	9		Eau Claire.....	0	1	
Minneapolis.....	32	2		Janesville.....	0	2	
Rochester.....	0	1		Kenosha.....	0	6	
Missouri:				Madison.....	1	1	
St. Louis.....	4	1		Sheboygan.....	0	1	
				Superior.....	2	2	

TETANUS.

City.	Cases.	Deaths.	City.	Cases.	Deaths.
California:			Minnesota:		
Los Angeles.....	1		Minneapolis.....	1	1
Illinois:			Pennsylvania:		
Chicago.....	1	1	Philadelphia.....		1
Michigan:			Texas:		
Muskegon.....	1	1	San Antonio.....		1

TUBERCULOSIS.

See p. 1494; also Current State summaries, p. 1483.

CITY REPORTS FOR WEEK ENDED JUNE 9, 1923—Continued.

TYPHOID FEVER.

The column headed "Median for previous years" gives the median number of cases reported during the corresponding week of the years 1915 to 1922, inclusive. In instances in which data for the full eight years are incomplete, the median is that for the number of years for which information is available.

City.	Median for previous years.	Week ended June 9, 1923.		City.	Median for previous years.	Week ended June 9, 1923.	
		Cases.	Deaths.			Cases.	Deaths.
Alabama:				Missouri:			
Birmingham.....	3	1		St. Louis.....	1	1	
Mobile.....	0	1	2	New Jersey:			
California:				Elizabeth.....	0	3	
Los Angeles.....	1	5	1	Newark.....	1	1	
Sacramento.....	0	2		Passaic.....	0	1	
Connecticut:				Plainfield.....	0	1	
Bridgeport.....	0	1		Trenton.....	1	1	
District of Columbia:				New York:			
Washington.....	2	5	2	Albany.....	1	1	
Florida:				Hornell.....	0	1	
Key West.....	4		1	New York.....	13	15	
Tampa.....	1	1	1	Newburgh.....	0	1	
Georgia:				White Plains.....	0	1	
Augusta.....	3	1		North Carolina:			
Brunswick.....	0	2		Durham.....	2	1	
Savannah.....	4	2		Ohio:			
Illinois:				Cincinnati.....	1	1	
Alton.....	0	1		Cleveland.....	2	1	
Chicago.....	4	3	1	Dayton.....	0	1	
Kewanee.....	2	1		Newark.....	0	2	
Peoria.....	0	1		Sandusky.....	0	1	
Quincy.....	0	1	1	Pennsylvania:			
Indiana:				Allentown.....	0	1	
Indianapolis.....	0	1		Harrisburg.....	0	1	
Mishawaka.....	0	1		Norristown.....	0	1	
Kansas:				Philadelphia.....	9	2	
Wichita.....	0	1		Pittsburgh.....	2	11	1
Kentucky:				Pottsville.....	0	1	
Covington.....	0	1		Scranton.....	0	1	
Louisville.....	1	4	2	Sharon.....	0	1	
Louisiana:				Uniontown.....	0	1	
New Orleans.....	4	1		South Carolina:			
Maine:				Columbia.....	2	1	
Lewiston.....	0	2		Tennessee:			
Maryland:				Nashville.....	3	2	
Baltimore.....	4	3		Texas:			
Cumberland.....	0	1		Amarillo.....		1	
Massachusetts:				El Paso.....	0	1	1
Fall River.....	3	1		San Antonio.....	0	1	1
Melrose.....	0	1		Virginia:			
North Adams.....	0	2		Richmond.....	1	1	
Michigan:				Washington:			
Detroit.....	4	3	1	Takoma.....	0	1	
Flint.....	0	1		West Virginia:			
Muskegon.....	0	1	1	Parkersburg.....	0		1
Saginaw.....	0	2	1	Wheeling.....	1	2	
Minnesota:							
Minneapolis.....	1	1					

TYPHUS FEVER.¹

City.	Cases.	Deaths.
Georgia, Atlanta.....	1	
Maryland, Baltimore.....	1	

¹ For week ended June 2, 1923.

CITY REPORTS FOR WEEK ENDED JUNE 9, 1923—Continued.

DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS.

City.	Population Jan. 1, 1920.	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuberculosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Alabama:										
Birmingham.....	178,806	59			95	2	1		13	2
Mobile.....	60,777	17	1		10				2	
Montgomery.....	43,464	10	1		11		3		2	
Tuscaloosa.....	11,996				21					
Arkansas:										
Fort Smith.....	28,870				7					
Little Rock.....	65,142				13				4	
North Little Rock.....	14,048				25				1	
California:										
Alameda.....	28,506	4			39					
Bakersfield.....	18,638		2				1			
Eureka.....	12,923	7	1		10		2			
Glendale.....	13,536	11								
Long Beach.....	55,593	17	1		4				2	2
Los Angeles.....	576,673	224	38	1	129	2	21	1	66	26
Oakland.....	216,261	42	10		79		11		1	2
Pasadena.....	45,354	14			29		3		2	2
Richmond.....	16,843	4	1		2		2			
Riverside.....	19,341	13	1		1		1			
Sacramento.....	65,908	16	1		68		6		9	2
San Bernardino.....	18,721	10			7					
San Diego.....	74,683	20			19		6		7	1
San Francisco.....	506,676	118	20		178		16		10	2
Santa Ana.....	15,485	6					3		1	7
Santa Cruz.....	10,917	7							1	1
Vallejo.....	21,107	4							1	1
Colorado:										
Denver.....	256,491	64	21	3	206	4	8			5
Pueblo.....	43,050	8	4		3				7	
Trinidad.....	70,906	1	1		3	1				
Connecticut:										
Bridgeport.....	143,555	28	6		13		13		7	
Bristol.....	20,620	2								
Fairfield (town).....	11,475	2	1		2				1	
Greenwich (town).....	22,123		2		15		1			
Hartford.....	138,086	24	6	2			3		4	2
Milford (town).....	10,193	3			2					1
New Haven.....	162,537	38	1		11		1		1	3
District of Columbia:										
Washington.....	437,571	113	2	1	139	3	17		18	8
Florida:										
Key West.....	18,749	4								
Tampa.....	51,608	9	1		3				1	1
Georgia:										
Albany.....	11,555				6					
Atlanta.....	200,616	76	2	1	24	1	4		1	8
Augusta.....	52,548	20	1		78	3				1
Brunswick.....	14,413	0			1					
Rome.....	13,252		1		13					
Savannah.....	83,252	33			37	2	1		2	3
Idaho:										
Boise.....	21,393	5								
Illinois:										
Alton.....	24,682	6	1		12				2	
Aurora.....	36,397	14	5	1	15		1		4	3
Bloomington.....	28,725	2			9					
Blue Islands.....	11,424	5	1		24					1
Centralla.....	12,491	7	1		15					
Chicago.....	2,701,705	661	78	3	435	8	72	1	246	58
Cicero.....	44,995	2	1		22				1	
Decatur.....	43,818	9			91				1	1
East St. Louis.....	66,767	10	2		3				1	1
Elgin.....	27,454	4			22		1			
Evanston.....	37,234	11	1		60					
Freeport.....	19,669	6			39					2
Galesburg.....	23,834	9	1		5		1			
Jacksonville.....	15,713	9	1		1				2	1
Kewanee.....	16,026	5	1		1		1			
La Salle.....	13,050	5			2					
Mattoon.....	13,552				11		1			
Oak Park.....	39,858	18	1		55		1			
Pekin.....	12,086		1							
Peoria.....	76,121	19			6					

CITY REPORTS FOR WEEK ENDED JUNE 9, 1923—Continued.

DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS—Continued.

City.	Population Jan. 1, 1920.	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuberculosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Illinois—Continued.										
Quincy.....	35,978	11	3		19		1			
Rock Island.....	35,177	7	3		47					1
Springfield.....	59,183	20	3		4		1		1	
Urbana.....	10,244				16					
Indiana:										
Anderson.....	29,767	7	1		50				1	
Bloomington.....	11,595	5			9					
Crawfordsville.....	10,139	4								
Elwood.....	10,790	1			4					
Fort Wayne.....	86,549	25	3	1						1
Frankfort.....	11,585	1			28	1				
Gary.....	55,378	14			5	1	9			3
Hammond.....	36,004	13			1	1	4			1
Huntington.....	14,000	1			1					
Indianapolis.....	314,194	95	8		486	2	2		9	9
Kokomo.....	30,067	7			31					
La Fayette.....	22,486	15			29				1	1
Logansport.....	21,626	1			4					
Michigan City.....	19,457	2					2			
Mishawaka.....	15,195	2								
Muncie.....	36,524	8	1		75					2
South Bend.....	70,983	10			1		7		2	
Terre Haute.....	66,083	22	2		16		3			
Iowa:										
Burlington.....	24,057				6		1			
Council Bluffs.....	36,162	5	1							
Davenport.....	56,727		1		5					
Dubuque.....	39,141				1		1			
Iowa City.....	11,267						1			
Muscatine.....	16,068	4			1					
Ottumwa.....	23,003		1							
Sioux City.....	71,227	0					2			
Waterloo.....	36,230				42		7			
Kansas:										
Atchison.....	12,630		1							
Coffeyville.....	13,452	4			7					
Fort Scott.....	10,693	3			1					
Kansas City.....	101,177		2		124		1		10	
Parsons.....	16,028				3				7	
Topeka.....	50,022	11	5		63				1	1
Wichita.....	72,217	10	1		48					
Kentucky:										
Covington.....	57,121	17			8					4
Henderson.....	12,169	6								1
Lexington.....	41,534	16			8					2
Louisville.....	234,891	82			20		1		17	7
Louisiana:										
New Orleans.....	387,219	125	2		19	9	2		40	14
Maine:										
Auburn.....	16,985	7			13		4		1	
Bangor.....	25,978	2	2	2	41					
Bath.....	14,731	2								
Biddeford.....	18,008	3					1			
Lewiston.....	31,791	13			21	1	5			1
Portland.....	69,272	23	2		6					
Sanford (town).....	10,691	2			2		1			
Waterville.....	13,351				1					
Maryland:										
Baltimore.....	733,826	234	27		440	6	89	2	28	22
Cumberland.....	29,837	7			8				1	
Frederick.....	11,066	4			2				1	
Massachusetts:										
Adams (town).....	12,967	1								
Amesbury (town).....	10,036	3								
Arlington (town).....	18,065	4	1		1		3			
Attleboro.....	19,731	6			2				2	1
Beverly.....	22,561	7					3			
Boston.....	748,060	233	58	7	203		98	1	52	20
Braintree (town).....	10,580	3	2		19		3			1
Brookton.....	66,254	12			43		4		3	
Brookline.....	37,748	14			36		1		1	
Cambridge.....	109,694	27	2		27		15		3	2
Chelsea.....	43,184	10			1		4		2	

CITY REPORTS FOR WEEK ENDED JUNE 9, 1923—Continued.

DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS—Continued.

City.	Population Jan. 1, 1920.	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuberculosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Massachusetts—Continued.										
Chicopee.....	36,214	8					4		2	
Clinton.....	12,979	1	1						1	
Danvers.....	11,108								1	
Dedham.....	10,792	2								
Easthampton.....	11,261	1								1
Everett.....	40,120	5	3		8		1			
Fall River.....	120,485	25	6		2		6		6	4
Frammingham.....	17,033	7			6		3			
Gardner.....	16,971	5			1					
Greenfield.....	15,462	2								
Haverhill.....	53,884	10	1		91		10		1	1
Lawrence.....	94,270	22	1		31				3	1
Leominster.....	19,744	0			2					
Lowell.....	112,759	29	4		8		5		4	6
Lynn.....	99,148	18	2		2		3		2	
Malden.....	40,103	3	4	1	12		2		1	1
Medford.....	39,038	14			5		2		1	2
Melrose.....	18,204	3	1		10		2			
Methuen.....	15,189	6	1		4	1			1	
Milford.....	13,471	5			2					
New Bedford.....	121,217	24			2		1			
Newburyport.....	15,618	4	1	1	3		1			
Newton.....	46,054	7			4		3			
North Adams.....	22,282	6								
Northampton.....	21,951	15					2			
Pittsfield.....	41,763	7	2				2		3	
Plymouth.....	13,045	4								
Quincy.....	47,876	7	5		8		4		3	
Salem.....	42,529		1		1		1			
Somerville.....	93,091	17	2		5		4		2	2
Southbridge.....	14,245	3			12		1			
Springfield.....	129,614	22	3		11		3		4	1
Taunton.....	37,137	10					6			
Wakefield.....	13,025	16			17					
Waltham.....	30,915	11	1		1				2	3
Watertown.....	21,457	2			6		6			
Webster.....	13,258	4					1			
West Springfield.....	13,443	2								
Westfield.....	18,604	6					5			
Winthrop.....	15,455	3	2	1	1		1			
Woburn.....	16,574	1								
Worcester.....	179,754	45	1				16			2
Michigan:										
Alpena.....	11,101				1					
Ann Arbor.....	19,516	11	1		40		1			
Battle Creek.....	36,164	0	3		109		2		2	
Benton Harbor.....	12,233	2			1					
Detroit.....	963,678	272	27	6	396	10	64	1	53	27
Flint.....	91,599	29	4	2	81	1	4		2	
Grand Rapids.....	137,634	35	5	1	423		4		6	2
Hamtramck.....	48,615	7	2		6					1
Highland Park.....	46,499		2		42		7			
Kalamazoo.....	48,487	16	2		18	1	4		3	2
Marquette.....	12,718	3	3				1			
Muskegon.....	36,570	9			48					
Pontiac.....	34,273	9	7		80		11		1	1
Port Huron.....	25,944	6			36		2			
Saginaw.....	61,903	25	3		107		9		1	1
Sault Ste-Marie.....	12,096	2								
Minnesota:										
Duluth.....	98,917	19			3		6		3	3
Faribault.....	11,089	5			11					1
Minneapolis.....	380,582	93	5	1	129	3	17		19	6
Rochester.....	13,722	13					1			1
St. Cloud.....	15,873				1				1	
Winona.....	19,143				1					
Missouri:										
Cape Girardeau.....	10,252	4			3					
Joplin.....	29,902				5					
Kansas City.....	324,410	90	8	1	137	2	1		9	5
St. Joseph.....	77,939	24			29					
St. Louis.....	772,897	211	20	1	67	2	13		44	12

CITY REPORTS FOR WEEK ENDED JUNE 9, 1923—Continued.

DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS—Continued.

City.	Population Jan. 1, 1920.	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuberculosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Montana:										
Billings.....	15,100	3					2		2	
Great Falls.....	24,121	7							2	
Helena.....	12,037	2			8					
Missoula.....	12,668	9					5		1	1
Nebraska:										
Lincoln.....	54,948	12	2		2		1			1
Omaha.....	191,601	32	4		1					2
Nevada:										
Reno.....	12,016	3			3					
New Hampshire:										
Berlin.....	16,104	5								1
Dover.....	13,029	5			2					
Keene.....	11,210	3								1
Manchester.....	78,384	23	2	1	4					
Nashua.....	28,379	13			28					
New Jersey:										
Asbury Park.....	12,400	2			4		2		1	
Atlantic City.....	50,707	10	1		2		1		1	
Bayonne.....	76,754		4						2	
Bloomfield.....	22,019	1			1		1			
Clifton.....	26,470	7	2		4				1	1
East Orange.....	50,710	10			32				1	
Elizabeth.....	95,783	4	6		19		3		5	
Garfield.....	19,381	0	1		1					
Hackensack.....	17,667	4			31				2	1
Harrison.....	15,721	2	2	1			2			
Hoboken.....	68,166	17			3		2			3
Jersey City.....	298,103		10		9		3		10	
Kearny.....	26,724	4			21					
Long Branch.....	13,521	2			4				1	1
Montclair.....	28,810	7			16		1		3	
Morristown.....	12,548	7					2			
Newark.....	414,524	91	12		100	1	13		13	7
Orange.....	33,268	9			5		2		1	2
Passaic.....	63,841	19	1		2		6		1	3
Paterson.....	135,875		6		85		3		6	
Phillipsburg.....	16,923	4	1							
Plainfield.....	27,700	9			1		2			
Summit.....	10,174	4			22					
Trenton.....	119,289	38	4		2		9		5	4
Union (town).....	20,651		1		1					
West Hoboken.....	40,074	7	1		2					
West New York.....	29,926	2	4		7					
West Orange.....	15,573	1	1		4		3			
New Mexico:										
Albuquerque.....	15,157	11	2	1	14		1		2	1
New York:										
Albany.....	113,344		2		210		5		8	
Amsterdam.....	33,524	11	4		9		2		1	
Buffalo.....	506,775	167	13	3	127	2	21		21	9
Cohoes.....	22,987	6			4					
Dunkirk.....	19,336	7			9		1			
Geneva.....	14,648	3								
Hornell.....	15,025	2			16		1			
Hudson.....	11,745	1								
Ithaca.....	17,004	7			30					2
Jamestown.....	38,917	2	1		34		1			
Lackawanna.....	17,918	6	1		5				5	
Little Falls.....	13,029	2								
Lockport.....	21,308	6			7		1		1	
Middletown.....	18,420				17					
Mount Vernon.....	42,726	5	2				1			
New York.....	5,620,048	1,413	178	13	773	10	184	2	1,225	181
Newburgh.....	30,366	11			5		1		1	1
Niagara Falls.....	50,760	18			29		5	1		
North Tonawanda.....	15,482	4	1		17		1			
Peekskill.....	15,868	4			4		4		1	
Plattsburg.....	10,909	4								
Rochester.....	286,750	39	9	1	74	1	2		21	1

Pulmonary tuberculosis only.

CITY REPORTS FOR WEEK ENDED JUNE 9, 1923—Continued.

DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS—Continued.

City.	Population Jan. 1, 1920.	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuberculosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
New York—Continued.										
Saratoga Springs.....	13,181	4					6		1	
Schenectady.....	88,723	25	2		116		3		6	2
Syracuse.....	171,717	52	19		333	1	16		10	1
Troy.....	72,013	21			4				6	
White Plains.....	21,031				3		5		1	
Yonkers.....	100,176	13	9		34		12			1
North Carolina:										
Durham.....	21,719	7			11				1	
Greensboro.....	43,525	11			58					3
Raleigh.....	24,418	15			21					2
Rocky Mount.....	12,742	4								
Salisbury.....	13,884	1								
Winston-Salem.....	48,395	20			138		1		1	3
North Dakota:										
Grand Forks.....	14,010						1			
Ohio:										
Akron.....	208,435	29	2		33		2		7	
Ashtabula.....	22,082	3			4					
Barberton.....	18,811	3			2		1			1
Bucyrus.....	10,425	1			1		2		1	
Cambridge.....	13,104	5	1							
Canton.....	87,091				10		2			
Chillicothe.....	15,831	4								
Cincinnati.....	401,247	121	4		101	3	6		24	6
Cleveland.....	796,841	201	30	1	381	3	76	1	38	13
Columbus.....	237,031	66	1		20	1	2		2	5
Coshocton.....	10,847				1					
Dayton.....	152,559	28	2		24		5		2	
East Cleveland.....	27,292	3			20		4		1	
East Youngstown.....	11,237	1								
Findlay.....	17,021	4								
Fremont.....	12,468	3								
Kenmore.....	12,683				49					
Lancaster.....	14,706	6	1				1			1
Lima.....	41,326	8			64		1		1	
Lorain.....	37,295				2		8			
Mansfield.....	27,824	6			18					
Marion.....	27,891		1		6		1		1	
Martins Ferry.....	11,634	2			1		1		1	
Middletown.....	23,594	5			3				1	
New Philadelphia.....	10,718				14				1	
Newark.....	26,718	4			17					
Niles.....	13,080	2		1	2					
Norwood.....	24,966	4			3					1
Piqua.....	15,044	9			1					
Salem.....	10,305	2			23					
Sandusky.....	22,897	10			8		4		2	
Springfield.....	90,840	18	3							2
Toledo.....	243,164	76	6	1	31		66	1	4	6
Youngstown.....	132,358	17	10		90	2	3			
Zanesville.....	29,569	12			1		1			2
Oklahoma:										
Oklahoma.....	91,295	23			8		4			1
Tulsa.....	72,075				1				1	
Oregon:										
Portland.....	258,288	52	10		1		5		13	5
Pennsylvania:										
Allentown.....	73,502		7		17		2			
Altoona.....	60,331		2		2					
Ambridge.....	12,730				2					
Beaver Falls.....	12,802		1		3					
Berwick.....	12,181		1						1	
Bethlehem.....	50,358		2		35		3		2	
Bradford.....	15,325				10					
Bristol.....	10,273		1						1	
Canonsburg.....	10,632		1		1					
Carbondale.....	18,640		1		1				1	
Carlisle.....	10,916				1					
Carnegie.....	11,516						1			
Chambersburg.....	13,171									
Chester.....	58,030		1		3		1			
Cotetsville.....	14,515				1		2			
Dickson.....	11,049		1				2			

CITY REPORTS FOR WEEK ENDED JUNE 9, 1923—Continued.

DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS—Continued.

City.	Popula- tion Jan. 1, 1920.	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuber- culosis.		
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	
Pennsylvania—Continued.											
Donora.....	14,131				1						
Dubois.....	13,681				11						
Duquesne.....	19,011				1		2				
Easton.....	33,813				6						
Erie.....	93,372		3		177		2		2		
Farrell.....	15,586		1		2				1		
Greensburg.....	15,033				4						
Harrisburg.....	75,917				10		1				
Hazleton.....	32,277		1		10						
Homestead.....	20,452		1								
Jeannette.....	10,627		1		1						
Johnstown.....	67,327		4		31		8				
Lancaster.....	53,150		1		9		3				
Lebanon.....	24,643		4				3		1		
McKees Rocks.....	16,713		1								
McKeesport.....	46,781				1						
Meadville.....	14,568				20						
Monessen.....	18,179		1								
Mount Carmel.....	17,469		1		2						
Nanticoke.....	22,614		1		5		1				
New Castle.....	44,938						1				
New Kensington.....	11,987				2				1		
Norristown.....	32,319		2		9		1				
North Braddock.....	14,928				1						
Oil City.....	21,274		1		4						
Philadelphia.....	1,823,779	484	63	5	44		60		50	42	
Phoenixville.....	10,484		1		1						
Pittsburgh.....	588,343	187	21	2	73		19	1		10	
Plymouth.....	16,500				3						
Pottstown.....	17,431		1		1						
Reading.....	107,784		1		1		3		1		
Scranton.....	137,783		3		61						
Shamokin.....	21,204				3						
Sharon.....	21,747		1		2		3				
Shenandoah.....	24,726										
Steelton.....	13,428		1		4		1		1		
Sunbury.....	15,721		2								
Swissvale.....	10,908		1								
Tamaqua.....	12,363				10						
Uniontown.....	15,692				1						
Warren.....	14,272				129		1				
Washington.....	21,480				14		1				
West Chester.....	11,717				1						
Wilkes-Barre.....	73,833		5		39				2		
Wilkinsburg.....	24,403		1		8						
Williamsburg.....	36,198				9						
Woodlawn.....	12,495				2				1		
York.....	47,512				5						
Rhode Island:											
Cranston.....	29,407		4		3		2				
Cumberland (town).....	10,677		1								
East Providence (town).....	21,793				1						
Newport.....	30,255		3	4							
Pawtucket.....	64,248		16	1							
Providence.....	237,595		68	0	22	4	7		1	6	
South Carolina:											
Charleston.....	67,957		21		6					1	
Columbia.....	37,524		19		1					2	
Greenville.....	23,127		5		4					1	
South Dakota:											
Sioux Falls.....	25,202		7		3						
Tennessee:											
Knoxville.....	77,818		2		49		1		2	2	
Memphis.....	162,351		68		18		1		17	10	
Nashville.....	118,342		45	1	8	1			8	6	
Texas:											
Amarillo.....	15,494		6							3	
Beaumont.....	40,422		11								
El Paso.....	77,560		34	1	5				8	1	
Fort Worth.....	106,482		17	1	1				1		
Galveston.....	44,255		13								

CITY REPORTS FOR WEEK ENDED JUNE 9, 1923—Continued.

DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS—Continued.

City.	Popula- tion Jan. 1, 1920.	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuber- culosis.		
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	
Texas—Continued.											
Houston.....	138,276	33					2			3	
San Antonio.....	161,379	84			7				1	16	
Waco.....	38,500	17								2	
Utah:											
Provo.....	10,303	2									
Salt Lake City.....	118,110	22	4	1	9		1			3	
Vermont:											
Barre.....	10,008				18		1				
Burlington.....	22,779	13			63		1				
Rutland.....	14,954	10					1				
Virginia:											
Alexandria.....	18,060	2			4						
Charlottesville.....	10,688	4			4						
Danville.....	21,539	9	2		15				1		
Lynchburg.....	30,070	14			5				1		
Norfolk.....	115,777	8			68				6	6	
Petersburg.....	31,012	13			97				3		
Richmond.....	171,667	59	3		268	3	2		5	3	
Roanoke.....	59,842	15			13				4	1	
Washington:											
Seattle.....	315,312		4		64		14		33		
Spokane.....	104,437		6				6				
Tacoma.....	96,965		9		1		4				
West Virginia:											
Bluefield.....	15,282	3	1		4		1				
Clarksburg.....	27,869	4			83						
Fairmont.....	17,851				4		1		1		
Huntington.....	50,177	14				1	12			2	
Morgantown.....	12,127				1				1		
Parkersburg.....	20,059	7			18						
Wheeling.....	56,203	19			4		1		2	3	
Wisconsin:											
Appleton.....	19,561	3			7		1		1		
Ashland.....	11,334				24		1				
Beloit.....	21,284	11	1		34		6		3		
Eau Claire.....	20,906				32						
Fond du Lac.....	23,427	2			3						
Green Bay.....	31,017				39		3		3		
Janesville.....	18,293	5			2						
Kenosha.....	40,472	6	3		1		2		1		
Madison.....	38,378	5			54	1	3		1		
Manitowoc.....	17,563		1		44						
Marinette.....	13,610				8						
Milwaukee.....	457,147	86	14		24		112	3	14	3	
Oshkosh.....	33,162	21			79		1				
Racine.....	58,593	13			7		4				
Sheboygan.....	30,955	11	2		11		4			1	
Stevens Point.....	11,371				2		1				
Superior.....	39,671	9			16						
Waukesha.....	12,558				29		3				
Wausau.....	18,661		2		29						
West Allis.....	13,745		1				4				
Wyoming:											
Cheyenne.....	13,829	1			1		1				

FOREIGN AND INSULAR.

AUSTRIA.

Births and Deaths, 1910-1922.

The figures given in the table below were furnished by the vital statistics bureau of the city of Vienna. They show very vividly the effect of the World War on the birth and death rates in that city.

In 1915, the second year of the war, the death rate increased considerably, and it continued increasing with each new hardship and privation of war until 1918, in which year it reached its highest point, 51,497 deaths (as compared with 32,314 in 1913). In 1915 the number of births decreased to 31,686, and fell to 21,127 in 1918, the year of the highest death rate.

Improvement of conditions was noted in 1919, the first post-war year, with 40,932 deaths and 27,451 births. In 1921 the number of births again exceeded the deaths, as was also the case in 1922.

Among the causes of death, tuberculosis ranks first, with 11,531 deaths in 1918 (about 22 per cent of the total) and 5,552 deaths in 1922 (about 19 per cent of the total). Influenza, which raged in many parts of the world in 1918, also added heavily to the extraordinary death rate in Vienna in 1918.

In 1910 the population of Vienna was 2,031,498, as compared with 1,841,326 in 1920. In 1916 the population was 2,220,511.

Births and deaths in Vienna from 1910 to 1922.

Year.	Deaths.	Births.	Year.	Deaths.	Births.
1910.....	33,311	48,669	1917.....	46,131	22,627
1911.....	33,684	45,154	1918.....	51,497	21,127
1912.....	32,141	44,251	1919.....	40,932	27,451
1913.....	32,314	41,690	1920.....	34,197	30,780
1914.....	33,238	40,213	1921.....	28,297	31,777
1915.....	37,018	31,686	1922.....	30,068	32,857
1916.....	37,631	26,077			

CANADA.

Decrease in Mortality from Tuberculosis.

A statement made, May 21, 1923, by the president of the London (Ontario) Health Association shows that, according to the Dominion of Canada census of 1901, the deaths from pulmonary tuberculosis

(1501)

were 9,709 in a population of over 5,000,000, while in 1921, with a population of 8,000,000, the deaths from this disease numbered only about 10,000. During the last two decades the death rate in Canada was stated to have dropped from 130 per 100,000 of population to 83 per 100,000. The death rate at the sanatorium near London, Ontario, was stated for 1922 as 65 per 100,000.

This decrease in tuberculosis death rate was attributed, first, to earlier recognition of the disease and to earlier and better treatment in sanatoriums, and, secondly, to the removal of tuberculous patients from their homes to sanatoriums and the consequent improvement in living conditions on their return home.

ESTHONIA.

Communicable Diseases—April, 1923.

Communicable diseases have been reported in the Republic Esthonia as follows:

APRIL 1-30, 1923.

Disease.	Cases.	Remarks.
Diphtheria.....	52	
Measles.....	293	
Scarlet fever.....	57	
Smallpox.....	6	
Tuberculosis.....	149	
Typhoid fever.....	21	
Typhus fever.....	8	Paratyphus fever, 6 cases.

FRANCE.

Plague—Vicinity of Paris.

Under date of June 11, 1923, the occurrence of four cases of plague with two deaths, during the period May 20 to 22, 1923, was reported at St. Ouen, a suburb of Paris, France. The dates of occurrence were stated as follows: May 20, one case; May 21, one case with one death; May 22, two cases with one death.

HUNGARY.

Typhus Fever—Budapest—Country Districts.

Information dated April 5, 1923, shows an outbreak of typhus fever at Budapest, Hungary, in February, 1923, with a total of 14 cases, of which nearly all were stated to have been imported from the country. Some spread of the disease was reported for the country districts, 76 cases being reported in the county of Heves, occurring in wandering gypsies, and six cases in the county of Fejer.

PERU.

Mortality—Callao—Lima—1918-1922.

The following tables have been compiled from statistics prepared by the Bureau of Public Health of Peru. The population of the city of Lima was estimated at 168,000 in 1918 and 176,000 in 1921. The population of Callao was estimated at 52,000 in 1920.

Mortality in Callao, Peru, 1919 to 1922, inclusive.

Disease.	1919	1920	1921	1922
Childbirth.....	6	5	4	12
Diphtheria and croup.....	1	1	2	3
Enteritis (0-1 year).....	108	135	105	136
Enteritis (1-2 years).....	23	38	41	39
Influenza.....	34	54	26	7
Malaria.....	23	24	15	12
Measles.....	7	3	1	7
Plague.....	7	30	21	24
Smallpox.....	1	1	1	5
Tuberculosis (pulmonary).....	180	182	278	342
Tuberculosis (other forms).....	66	47	32	58
Typhoid fever.....	18	28	17	24
Whooping cough (convulsive).....	.....	7	3	12
Total.....	483	555	545	681
Other illnesses.....	883	939	792	914
Total.....	1,366	1,494	1,337	1,595

Deaths of infants under 1 year of age in Callao, Peru, 1918 to 1922, inclusive.

Disease.	1918	1919	1920	1921	1922
Bronchitis.....	6	11	16	7	9
Diarrhea and enteritis.....	154	108	135	105	136
Diphtheria.....	1	.....	1	1	.....
Influenza.....	3	2	6	5	1
Malaria.....	1	2	5	3	3
Measles.....	1	2	1	.....	3
Meningitis (ordinary).....	19	15	29	24	28
Pneumonia (broncho).....	11	16	19	24	19
Pneumonia.....	1	1	10	3	4
Smallpox.....	.....	.....	.....	.....	1
Syphilis (hereditary).....	2	1	.....	3	1
Tubercular meningitis.....	1	2	.....	.....	3
Tuberculosis (pulmonary).....	5	4	5	3	13
Tuberculosis (other forms).....	3	.....	2	.....	5
Typhoid fever.....	.....	.....	.....	.....	1
Whooping cough (convulsive).....	.....	.....	4	2	6
Total.....	208	164	233	180	233
Other illnesses.....	34	31	35	37	35
No medical attention.....	187	151	204	142	162
Total.....	429	346	472	359	430

Mortality in Lima, Peru, 1918 to 1921, inclusive.

Disease.	1918	1919	1920	1921
Childbirth.....	26	12	25	36
Diphtheria and croup.....	7	6	6	13
Enteritis (0-1 year).....	551	519	474	500
Enteritis (1-2 years).....	175	132	103	135
Influenza.....	347	171	204	110
Malaria.....	188	146	100	112
Measles.....	18	66	20	12
Plague.....	37	30	39	57
Scarlet fever.....	1	.....	2	1
Smallpox.....	.....	.....	.....	3
Tuberculosis (pulmonary).....	929	889	755	706
Tuberculosis (other forms).....	216	282	215	219
Typhoid fever.....	95	82	105	87
Typhus fever.....	.....	2	2	.....
Whooping cough (convulsive).....	.....	.....	17	40
Total.....	2,590	2,339	2,067	2,121
Other illnesses.....	3,095	2,859	3,014	2,640
Total.....	5,685	5,198	5,081	4,761

Deaths of infants under one year of age in Lima, Peru, 1918 to 1921, inclusive.

Disease.	1918	1919	1920	1921
Bronchitis.....	38	34	42	47
Diarrhea and enteritis.....	551	519	474	500
Diphtheria.....	.....	3	.....	1
Influenza.....	34	25	27	21
Malaria.....	35	27	24	25
Measles.....	4	18	5	3
Meningitis (ordinary).....	64	91	101	91
Pneumonia (broncho).....	58	64	110	94
Pneumonia.....	13	4	8	8
Scarlet fever.....	1	.....	.....	.....
Smallpox.....	.....	.....	.....	2
Syphilis (hereditary).....	14	21	20	32
Tubercular meningitis.....	4	6	8	5
Tuberculosis (pulmonary).....	30	23	24	46
Tuberculosis (other forms).....	6	7	6	18
Typhoid fever.....	.....	2	5	.....
Whooping cough (convulsive).....	.....	1	17	20
Total.....	852	815	871	913
Other illnesses.....	117	113	89	165
No medical attention.....	343	251	392	260
Total.....	1,312	1,209	1,352	1,338

POLAND.**Communicable Diseases—February 25–March 3, 1923.**

Communicable diseases have been reported in Poland as follows:

FEBRUARY 25–MARCH 3, 1923.

Disease.	Cases.	Deaths.	Districts and city showing greatest mortality.
Cerebrospinal meningitis.....	27	6	Kielce.
Diphtheria.....	68	11	Lodz.
Measles.....	813	32	Lodz.
Scarlet fever.....	218	32	Stanislawow.
Smallpox.....	5	3	Stanislawow.
Tuberculosis.....	145	234	Warsaw City.
Typhoid fever.....	238	23	Krakow; Lodz.
Typhus fever.....	446	25	Lwow.
Typhus fever, recurrent.....	119	5	Eastern Territories.
Whooping cough.....	66	5	Lwow; Stanislawow.

Dysentery.

During the period under report, 17 cases of dysentery with 3 deaths were reported in Upper Silesia, Poland.

SYRIA.**Lethargic Encephalitis—Beirut.**

During the 10-day period ended April 10, 1923, a case of lethargic encephalitis was reported at Beirut, Syria.

TRINIDAD.**Epidemic Influenza.**

Under date of June 5, 1923, epidemic influenza was reported prevalent in the island of Trinidad, West Indies. In Port of Spain, the capital, where the number of reported cases was stated to be large, there were few deaths from the disease reported. In some of the poorer districts the mortality was considerable.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER.

The reports contained in the following tables must not be considered as complete or final as regards either the list of countries included or the figures for the particular countries for which reports are given.

Reports Received During Week Ended June 29, 1923.¹**CHOLERA.**

Place.	Date.	Cases.	Deaths.	Remarks.
India.....	.....	.....	.....	Apr. 8-14, 1923: Cases, 1,902; deaths, 1,278.
Madras.....	May 6-12.....	1	.....
Rangoon.....	Apr. 29-May 5.....	3	2	
Siam:				
Bangkok.....	Apr. 15-28.....	3	2	

PLAGUE.

Ceylon:				
Colombo.....	Apr. 29-May 5.....	3	3	Plague rodents, 4.
China:				
Hongkong.....	Apr. 15-28.....	7	6	
France:				
St. Ouen.....	May 20-22.....	4	2	Vicinity of Paris.
India.....	.....	.....	.....	Apr. 22-28, 1923: Cases, 6,241; deaths, 4,784.
Madras Presidency.....	May 6-12.....	88	58	
Rangoon.....	Apr. 29-May 5.....	22	24	
Siam:				
Bangkok.....	Apr. 15-28.....	23	19	
Straits Settlements:				
Singapore.....	Apr. 29-May 5.....	2	2	

¹ From medical officers of the Public Health Service, American consuls, and other sources.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received During Week Ended June 29, 1923—Continued.

SMALLPOX.

Place.	Date.	Cases.	Deaths.	Remarks.
Brazil:				
Rio de Janeiro.....	Apr. 29-May 12....	1	1	
Sao Paulo.....	Feb. 19-25.....		1	
Canada:				
British Columbia—				
Vancouver.....	Apr. 1-May 26....	86		
Saskatchewan—				
Regina.....	May 6-19.....	2		
Ceylon:				
Colombo.....	Apr. 30-May 5....	1		
China:				
Amoy.....	May 6-12.....		1	Present.
Chungking.....	..do.....			Do.
Foochow.....	..do.....			
Hongkong.....	Apr. 15-28.....	27	21	
Manchuria—				
Dairen.....	Apr. 30-May 6....	1		
Estonia.....				Apr. 1-30, 1923: Cases, 6.
Greece:				
Patras.....	Apr. 2-22.....		9	
India.....				Apr. 8-14, 1923: Cases, 2,432;
Madras.....	May 6-12.....	6	3	deaths, 494.
Rangoon.....	Apr. 30-May 5....	25	12	
Java:				
West Java—				
Batavia.....	Apr. 28-May 4....	10	2	
Mexico:				
Mexico City.....	May 6-19.....	67		
Vera Cruz.....	May 28-June 3....		1	
Poland.....				Feb. 25-Mar. 3, 1923: Cases, 5;
				deaths, 3.
Portugal:				
Oporto.....	May 27-June 2....	2		
Siam:				
Bangkok.....	Apr. 22-28.....	5	1	
Society Islands:				
Tahiti.....	May 13-26.....	1	1	
Switzerland:				
Basel.....	May 13-19.....	3		
Zurich.....	..do.....	2		
Syria:				
Beirut.....	Apr. 11-20.....	1		
Turkey:				
Constantinople.....	May 6-12.....		10	

TYPHUS FEVER.

Chile:				
Talcahuano.....	Mar. 26-May 12...	3	1	
China:				
Hankow.....	May 13-19.....	1		
Egypt:				
Port Said.....	May 20-26.....	1		
Estonia.....				Apr. 1-30, 1923: Cases, 8. Para-
				typhus, cases, 6.
Greece:				
Athens.....	Apr. 1-30.....		5	
Patras.....	Apr. 2-22.....		16	
Hungary:				
Budapest.....	May 6-12.....	3	1	
Italy:				
Catania.....	May 7-13.....	1		
Mexico:				
Mexico City.....	May 6-19.....	32		Including municipalities in Fed-
				eral District.
Poland.....				Feb. 25-Mar. 3, 1923: Cases, 446;
				deaths, 25. Recurrent typhus:
				Cases, 119; deaths, 5.
Rumania:				
Kishineff District.....	Apr. 1-30.....	16		
Syria:				
Aleppo.....	May 13-19.....	4		Refugees.
Beirut.....	Apr. 11-20.....	2		
Turkey:				
Constantinople.....	May 6-12.....		15	
Union of South Africa:				
Orange Free State.....	Apr. 23-28.....			Outbreaks.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 30, 1922, to June 29, 1923.¹

CHOLERA.

Place.	Date.	Cases.	Deaths.	Remarks.
China:				
Liutaoku.	Sept. 22.....	60	20	
Chosen (Korea):				
Yalu River region.				Sept. 22, 1922: 30 deaths reported.
India:				Sept. 24-Dec. 30, 1922: Cases, 14,637; deaths, 8,833. Dec. 31, 1922-Apr. 14, 1923: Cases, 20,303; deaths, 13,094.
Bombay.	Oct. 27-Dec. 23....	2	1	
Do.	Feb. 4-Apr. 21....	7	7	
Calcutta.	Nov. 12-Dec. 30....	102	60	
Do.	Dec. 31-May 5.....	453	335	
Madras.	Nov. 19-Dec. 16....	4	2	
Do.	Jan. 21-May 12....	14	6	
Rangoon.	Nov. 12-Dec. 23....	17	10	
Do.	Dec. 31-May 5.....	29	20	
Philippine Islands:				
Province—				
Laguna.	Oct. 12-18.....	1		
Zamboanga.	Feb. 11-17.....	1	1	
Russia:				Jan. 1-Oct. 7, 1922: Cases, 83,367.
Archangel (Government).	Oct. 1-7.....	7		
Moscow.	Jan. 1-31.....	1		
Tashkent.	Oct. 1-7.....	27		
Ukraine:				Turkestan Republic: 3 cases reported on waterways.
Donetz (Government).	Sept. 1-30.....	29		Sept. 1-30, 1922: Cases, 119.
Tchernigov (Government).	do.....	36		
Siam:				
Bangkok.	Oct. 29-Dec. 23....	4	1	
Do.	Dec. 31-Apr. 28....	13	5	

PLAGUE.

Argentina:				
Rosario.	Feb. 10-27.....	8	3	
Azores:				
Fayal Island—				
Castelo Branco.	Dec. 2-31.....		3	Vicinity of Horta. Dec. 30, 1922.
Do.	Mar. 12-18.....	2		Several cases.
Horta.	Mar. 23.....	1		Actual occurrence about Mar. 6, 1923.
Pico Island—				
Lages.	Nov. 27-Dec. 15....		8	
St. Michael Island.				Nov. 12-Dec. 30, 1922: Cases, 100; deaths, 35. At localities 3-9 miles from Ponta Delgada.
Ponta Delgada.	Nov. 26-Dec. 9.....	3		Dec. 31, 1922-Apr. 28, 1923: Cases, 179; deaths, 74. From 6 to 20 miles distant from port of Ponta Delgada.
Brazil:				
Bahia.	Oct. 29-Dec. 30....	5	5	
Do.	Jan. 28-Apr. 21....	2	2	
Pernambuco.	Jan. 14-20.....	3	2	
Porto Alegre.	Nov. 19-25.....	1		
British East Africa:				
Kenya Colony—				
Tanganyika Territory.	Oct. 15-Dec. 16....	12	7	
Do.	Jan. 14-Feb. 10....	11	10	
Uganda.				Dec. 1-31, 1922: Cases, 141; deaths, 129. Jan. 1-31, 1923: Cases, 73; deaths, 73.
Entebbe.	Nov. 24-30.....	211	202	
Do.	Mar. 1-31.....	18	15	
Canary Islands.				Jan. 15-Mar. 17, 1923: Cases, 8; deaths, 7. Apr. 13, 1923: Present. Rodent plague present, Feb.-Mar., 1923.
Celebes:				
Macassar.	Feb. 15.....			Present, bubonic; epidemic, pneumonic.
Ceylon:				
Colombo.	Nov. 12-Dec. 30....	46	38	Plague rodents, 16.
Do.	Dec. 31-May 5.....	97	81	Plague rodents, 47.

¹ From medical officers of the Public Health Service, American consuls, and other sources.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 30, 1922, to June 29, 1923—Continued.

PLAGUE—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Chile:				
Antofagasta.....				Quarantine. Year, 1922: March, 1 case; May, 1 case.
China:				
Hongkong.....	Nov. 5-Dec. 23....	14	12	
Do.....	Dec. 31-Apr. 28....	12	9	
Manchuria—				
Harbin.....	Jan. 29-Feb. 4....	7		
Ecuador:				
Guamote.....	Apr. 24.....	20	5	Railway town.
Guayaquil.....	Nov. 1-Dec. 31....	9	3	Rats examined, 21,000; found infected, 90.
Do.....	Jan. 1-May 15....	26	12	Rats examined, 35,990; found infected, 184.
Sabanilla.....	Mar. 1-15.....	1		Country estate.
Egypt:				Jan. 1-Dec. 28, 1922: Cases, 485; deaths, 228. Jan. 1, 1922-Jan. 4, 1923: Cases, 487; deaths, 228.
City—				Jan. 1-Mar. 29, 1923: Cases, 134; deaths, 69. Mar. 19-25, 1922: Cases, 50—Assiout, 29; Fayoum, 4; Girgeh, 17.
Alexandria.....	Nov. 19-25.....	2		
Do.....	Jan. 8-10.....	1	1	
Port Said.....	Nov. 19-27.....	4	2	
Do.....	Jan. 26-Mar. 5....	2	1	
Suez.....	Nov. 18-Dec. 5....	3	4	
Do.....	Mar. 2.....	1	1	
Province—				
Assiout.....	Nov. 19-Dec. 29....	4	1	Septicemic: 1 case, 1 death.
Do.....	Jan. 26-Mar. 29....	56	28	Pneumonic, 8 cases, 4 deaths; bubonic, 36 cases; septicemic, 5 cases, 1 death.
Dakahlieh.....	Dec. 3.....	1	1	Pneumonic.
Fayoum.....	Mar. 25-28.....	3	1	Bubonic.
Girgeh.....	Mar. 24-27.....	6	4	Bubonic, 4; septicemic, 2.
Kena.....	Mar. 8.....	1	1	Pneumonic: 1 death.
Minieh.....	Nov. 18-27.....	2		
Do.....	Feb. 24.....		1	
France:				
St. Ouen.....	May 20-22.....	4	2	Vicinity of Paris.
Hawaii:				
Honokaa.....				Feb. 8-9, 1923: Plague rats, 3.
Do.....				Mar. 24-25, 1923: Plague rats, 2. In vicinity Pacific Sugar Co., near Honokaa.
Pohakaa.....				Apr. 15, 1923: Plague rat.
India:				Oct. 1-Dec. 30, 1922: Cases, 26,878; deaths, 20,095. Dec. 31, 1922-Apr. 28, 1923: Cases, 125,300; deaths, 98,326.
Bombay.....	Oct. 27-Dec. 30....	41	32	
Do.....	Dec. 31-Apr. 21....	813	650	
Calcutta.....	Feb. 11-May 5....	45	45	
Karachi.....	Dec. 10-16.....	1	1	
Do.....	Dec. 31-May 12....	230	176	
Madras Presidency.....	Nov. 19-Dec. 30....	2,269	1,448	
Do.....	Dec. 31-May 12....	6,246	5,389	
Madras.....	Nov. 19-25.....	1	1	
Do.....	Jan. 21-27.....	1	1	
Rangoon.....	Nov. 12-Dec. 30....	52	49	
Do.....	Dec. 31-May 5....	555	514	
Iraq (Mesopotamia):				
Bagdad.....	Oct. 1-Nov. 30....	16		
Do.....	Jan. 1-Mar. 31....	21		
Sumaichah.....	Mar. 14.....		30	Among Beni - Tenim tribes in vicinity. Locality about 30 miles from Bagdad.
Japan:				
Osaka.....				July 1-Nov. 30, 1922: Cases, 70.
Java:				Oct. 1-Nov. 3, 1922: Cases, 900; deaths, 763. Jan. 1-Mar. 31, 1923: Cases, 1,993; deaths, 2,052.
East Java.....				Dec. 1-31, 1922: Deaths, 990.
Residences—				
Pekalongan.....	Dec. 1-31.....	56		
Samarang.....	do.....	202		
Soerabaya.....	Oct. 22-Dec. 31....	34	14	
Do.....	Jan. 14-20.....	2	2	Jan. 17-23, 1923: Cases, 5; deaths, 3.
Toeleng-Agoeng	Oct. 29-Dec. 16....	18	18	Not a seaport.
Soerakarta—				
Klaten.....	Nov. 4.....			Present in epidemic form.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 30, 1922, to June 29, 1923—Continued.

PLAGUE—Continued.

Place	Date	Cases	Deaths	Remarks
Madagascar				Jan. 1-Dec. 30, 1922: Cases 143; Jan. 1-Mar. 31, 1923: Cases, 185; deaths, 130.
Provinces—				
Antsirabe	Jan. 16-Feb. 15	2	2	Bubonic and septicemic.
Diego Suarez	Jan. 1-Mar. 31	6	4	Do.
Moramanga				To Nov. 12, 1922: Cases, 24; deaths, 21. Cases reported to Oct. 30, pneumonic.
Amparafara region	Sept. 18-Nov. 5	21		Bubonic, 18; septicemic, 3 (doubtful, 2).
Moramanga	Dec. 6-9	3		Bubonic.
Tamatave	Feb. 10-Sept. 12	10		Do.
Do.	Mar. 1-15	1	1	Septicemic.
Miatinarivo				Dec. 14, 1922-Jan. 1, 1923: 1 case (European).
Tananarive				Jan. 1-Dec. 10, 1922. Cases, 73 (bubonic, 37; pneumonic, 8; septicemic, 28). Jan. 1-Mar. 31, 1923: Cases, 152; deaths, 113. Bubonic, pneumonic, septicemic.
Ambohimangakeley	Nov. 19-Dec. 10	9		Bubonic, 3; pneumonic, 3; septicemic, 3.
Anketrina	Mar. 27-May 9	11		Bubonic, 4; pneumonic, 2; septicemic, 5 (3 doubtful).
* Fencarivo region	Oct. 7-Nov. 28	16		Bubonic, 3; pneumonic, 8; septicemic, 5.
Tananarive	Oct. 23-Dec. 10		5	1 septicemic.
Do.	Dec. 14-Mar. 31	26	10	Bubonic and septicemic.
Mauritius				Year 1922: Cases, 98; deaths, 73. January, 1923: Cases, 18.
Mexico:				
Tampico	Mar. 23	6	1	Plague rodent found, Mar. 14, 1923.
Palestine:				
Jaffa	Nov. 27-Dec. 4	1		
Haifa	May 8-21	2		
Peru				Nov. 1-Dec. 31, 1922: Cases, 199; deaths, 13.
Do.				Jan. 1-Apr. 30, 1923: Cases, 466; deaths, 212.
Localities—				Present.
Ayabaca	Apr. 16-30			
Barranco	Feb. 1-Apr. 30	3	1	
Callao	Mar. 1-Apr. 30	4	1	
Canete	Nov. 16-Dec. 31	56	19	Including vicinity.
Do.	Jan. 1-Apr. 15	37	18	Do.
Casma	Jan. 1-31	1		At Campina.
Catacos	Jan. 1-Apr. 30	12	3	
Cerro Azul	Apr. 1-15	1		
Chepen	Dec. 16-31	2	1	Present, Nov. 9-15, 1922.
Do.	Jan. 1-Mar. 31	2		
Chiclayo (city and country)	Nov. 16-Dec. 15	17	7	
Do.	Jan. 1-Apr. 30	38	20	
Cutervo	Feb. 16-Apr. 30	81	51	
Eten	Nov. 16-Dec. 15	4		
Guadeloupe	Nov. 1-Dec. 31	22	12	
Do.	Jan. 1-31	4	1	
Huscho	Nov. 16-Dec. 31	4	2	
Do.	Jan. 1-Apr. 15	29	6	
Huancabamba	Apr. 1-15	1		Apr. 16-30, 1923: Present.
Huara	Jan. 1-Feb. 15	8		Country.
Huaral	Nov. 16-30	1		
Do.	Jan. 1-Feb. 28	4	2	
Huarmey	Dec. 1-31	2	2	
Do.	Feb. 1-Apr. 15	10		
Jayanca	Nov. 16-Dec. 31	10	8	
Lambayeque	do.	7	3	
Do.	Jan. 1-Feb. 15	10	7	
Lima (city)	Nov. 1-Dec. 31	11	8	
Do.	Jan. 1-Apr. 30	27	14	
Lima (country)	Nov. 1-Dec. 31	14	5	
Do.	Jan. 1-Apr. 30	16	4	
Lurin	Dec. 1-15	1		
Magdalena del Mar	Nov. 16-30	1		
Do.	Jan. 1-31	1	1	
Magdalena Vieja	Dec. 19-31	1	1	

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 30, 1922, to June 29, 1923—Continued.

PLAGUE—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Peru—Continued.				
Localities—Continued.				
Mala.....	Dec. 1-31.....	2	.....
Do.....	Jan. 1-Apr. 30.....	5	1	
Miraflores.....	Jan. 1-Feb. 15.....	5	2	
Mochumi.....	Dec. 16-31.....	3	3	
Do.....	Feb. 1-Mar. 31.....	6	2	
Mollendo.....	Mar. 1-31.....	1	.....
Monsefu.....	Feb. 1-15.....	5	3	
Mosche.....	Nov. 16-30.....	2	1	
Paita.....	Dec. 16-31.....	3	2	
Do.....	Jan. 1-Apr. 30.....	19	14	
Piura.....	Nov. 16-Dec. 31.....	12	7	
Do.....	Jan. 1-Mar. 31.....	23	10	
Pueblo Nuevo.....	Dec. 1-31.....	7	4	
Do.....	Jan. 1-31.....	10	6	
Salaverry.....	Apr. 1-30.....	5	1	
San Pedro.....	Nov. 1-Dec. 31.....	8	4	
Do.....	Jan. 1-Feb. 28.....	7	4	
Santa Cruz (Hualgayoc).....	Feb. 16-28.....	19	15	Apr. 16-30, 1923: Present.
Sullana.....	Nov. 16-30.....	3	3	
Do.....	Jan. 1-31.....	1	1	
Trujillo.....	Nov. 1-Dec. 31.....	3	1	
Do.....	Jan. 1-Mar. 31.....	66	17	District.
Tuman.....	Nov. 16-30.....	3	.....
Viru.....	Apr. 1-15.....	1	.....
Portugal:				
Lisbon.....	Nov. 10-29.....	4	2	
Oporto.....	Jan. 21-27.....	.....	1	
Portuguese West Africa:				
Angola—				
Loanda.....	Oct. 1-Dec. 30.....	.....	45	Fatal cases among white population.
Do.....	Dec. 31-Feb. 3.....	2	2	
Russia:				
Kirghiz Republic.....				
Siam:				
Bangkok.....	Nov. 12-Dec. 23.....	5	5	
Do.....	Dec. 31-Apr. 28.....	133	111	
Spain:				
Barcelona.....	Nov. 15-Dec. 18.....	1	.....	Sept. 24-Nov. 14, 1922: Cases, 23; deaths, 9.
Malaga.....	Feb. 27-May 14.....	5	1	17 suspected cases.
Straits Settlements:				
Singapore.....	Dec. 17-23.....	2	2	
Do.....	Jan. 21-May 5.....	21	18	
Syria:				
Beirut.....	Nov. 6-30.....	4	3	
Tunis:				
Ben-Gardane.....	Apr. 21.....	21	.....
Taguelmit.....	Apr. 1-30.....	30	30	Desert town. Probably outbreak reported for Ben-Gardane, Public Health Reports, May 18, 1923, p. 1110.
Turkey:				
Constantinople.....	Nov. 22-28.....	2	.....
Do.....	Jan. 28-Feb. 10.....	2	.....
Union of South Africa:				
Transvaal—				
Klipfontein Farm.....	Dec. 16.....	2	1	Natives. Jan. 25, 1923: Plague-infected wild rodent found in vicinity.
Do.....	Apr. 23.....	.....	.....	Present.
Venezuela:				
Victoria.....	May 23.....	4	2	
West Africa:				
Senegal—				
Dakar.....	Feb. 1-Apr. 30.....	3	3	
On vessels:				
S. S. Helcion.....	Dec. 1.....	1	.....	At Thursday Island Quarantine, Australia, from Singapore, Straits Settlements. In Chinese firemen.
S. S. —.....	Dec. 30.....	.....	.....	At port of London: Plague-infected rats and cats found in grain cargo on vessel from South America.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 30, 1922, to June 29, 1923—Continued.

SMALLPOX.

Place.	Date.	Cases.	Deaths.	Remarks.
Algeria:				
Algiers.....	Dec. 1-10.....	1	.....
Do.....	Jan. 1-Mar. 31.....	4	.....
Arabia:				
Aden.....	Nov. 19-Dec. 23.....	7	3	
Do.....	Jan. 7-Mar. 31.....	23	2	
Barbadoes (West Indies).....	Apr. 26.....	.....	.....	Present. (Reported as alastrim.
Bolivia:				
La Paz.....	Jan. 1-Mar. 31.....	17	15	
Brazil:				
Bahia.....	Nov. 5-11.....	1	.....
Do.....	Mar. 4-31.....	2	1	
Para.....	Feb. 12-Mar. 25.....	14	.....
Pernambuco.....	Jan. 21-Apr. 21.....	19	2	
Rio de Janeiro.....	Nov. 25-Dec. 30.....	40	15	
Do.....	Dec. 31-May 12.....	62	27	
Sao Paulo.....	Oct. 16-22.....	1	1	
Do.....	Jan. 8-Feb. 25.....	5	6	
British East Africa:				
Kenya Colony—				
Mombasa.....	Mar. 25-May 5.....	2	1	
Tanganyika Territory..	Oct. 8-Dec. 23.....	103	10	
Do.....	Jan. 7-Apr. 14.....	70	8	
Uganda.....	Sept. 1-Dec. 31.....	3	1	Jan. 1-31, 1923: Cases, 3; deaths, 1.
Entebbe.....	Nov. 24-30.....	3	3	
Do.....	Mar. 1-31.....	14	21	
Canada:				
Alberta—				
Calgary.....	Mar. 4-10.....	1	.....
British Columbia—				
Fernie.....	Mar. 18-24.....	1	.....
Vancouver.....	Apr. 1-May 26.....	86	.....
Manitoba—				
Winnipeg.....	Dec. 10-30.....	14	.....
Do.....	Jan. 21-May 26.....	70	.....
New Brunswick—				
Northumberland County.	Jan. 21-Feb. 17.....	8	.....
Restigonche County....	Mar. 11-17.....	1	1	
Ontario.....				Dec. 1-31, 1922: Cases, 51; deaths, 1. Jan. 1-May 31, 1923: Cases, 138.
Hamilton.....	Dec. 31-Feb. 24.....	7	.....
Niagara Falls.....	Dec. 3-30.....	10	.....
Do.....	Dec. 31-May 5.....	17	.....
Ottawa.....	Dec. 10-23.....	6	.....
Do.....	Jan. 7-Mar. 31.....	21	1	
Toronto.....	Dec. 10-30.....	2	.....
Do.....	Feb. 4-10.....	1	.....
Quebec—				
Quebec.....	Jan. 14-20.....	3	.....
Sherbrooke.....	Mar. 1-31.....	.....	2	
Saskatchewan—				
Regina.....	Dec. 3-23.....	2	.....
Do.....	May 6-19.....	2	.....
Ceylon:				
Colombo.....	Nov. 12-Dec. 24.....	9	4	1 case, 1 death outside city.
Do.....	Feb. 18-May 5.....	6	.....
Chile:				
Antofagasta.....	Apr. 1-7.....	1	.....
Concepcion.....	Oct. 30-Dec. 25.....	.....	7	
Do.....	Feb. 1-May 7.....	3	2	Mar. 1-Apr. 30, 1923: Deaths, 9. In hospital Dec. 26, 1922, 83 cases.
Valparaiso.....	Oct. 2-Dec. 30.....	.....	153	Dec. 31, 1922-Jan. 27, 1923: Deaths, 66. Feb. 16, 1923: 80 cases present (estimated). Jan. 29-May 12, 1923: Deaths, 224.
Do.....	Jan. 9-Feb. 10.....	.....	90	
China:				
Amoy.....	Nov. 5-Dec. 23.....	.....	3	Nov. 26-Dec. 30, 1922: Present.
Do.....	Jan. 7-May 12.....	.....	15	
Antung.....	Nov. 13-Dec. 10.....	2	.....
Do.....	Feb. 26-May 6.....	2	.....
Canton.....	Oct. 1-Nov. 30.....	.....	.....	Prevalent.
Do.....	Jan. 21-Mar. 31.....	.....	.....	Present.
Changsha.....	Feb. 11-17.....	1	.....
Chungking.....	Nov. 5-Dec. 30.....	.....	.....	Do.
Do.....	Dec. 31-May 12.....	.....	.....	Do.
Foochow.....	Nov. 12-Dec. 30.....	.....	.....	Do.
Do.....	Dec. 31-May 12.....	.....	.....	Do.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 30, 1922, to June 29, 1923—Continued.

SMALLPOX—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
China—Continued.				
Hankow.....	Dec. 31-Jan. 20....	4	1	
Hongkong.....	Nov. 5-11.....		1	
Do.....	Dec. 31-Mar. 31....	85	67	
Manchuria—				
Dairen.....	Apr. 2-May 6.....	5		
Harbin.....	Nov. 20-Dec. 31....	13		
Do.....	Jan. 8-May 5.....	11		
Mukden.....	Nov. 19-Dec. 16....			Present.
Do.....	Jan. 7-Feb. 3.....			Do.
Nanking.....	Nov. 5-Dec. 23....			Do.
Do.....	Jan. 7-Apr. 14....			Do.
Shanghai.....	Jan. 15-May 6.....	10	13	Cases, foreign: deaths, Chinese.
Tientsin.....	Feb. 18-Apr. 7.....	2		Reported from foreign office.
Chosen (Korea):				
Chemulpo.....	Oct. 1-Dec. 31....	135	92	
Do.....	Jan. 1-Apr. 30....	42	22	
Fusan.....	Nov. 1-Dec. 31....	4		
Do.....	Jan. 1-Apr. 30....	15	2	
Gensan.....	Dec. 1-31.....	6	2	
Do.....	Mar. 1-31.....	2	1	
Seoul.....	Oct. 1-Dec. 31....	19	1	
Do.....	Jan. 1-Apr. 30....	100	39	
Colombia:				
Buenaventura.....	Jan. 25-Feb. 20....	48		Estimated, 50 cases present; type, mild; among colored population. Feb. 16-26, 1923: 6 to 9 cases 2 miles from town limits.
Santa Marta.....	Apr. 18.....			Mild outbreak.
Cuba:				
Province—				
Camaguey.....	Nov. 11-Dec. 31....	20		
Matanzas.....	Jan. 1-31.....	2		
Oriente.....	Nov. 21-Dec. 31....	22		
Do.....	Jan. 1-Feb. 10....	10		
Santa Clara.....	Dec. 21-31.....	1		
Czechoslovakia:				
Province—				
Bohemia.....	Oct. 1-31.....	1		
Moravia.....	do.....	1		
Slovakia.....	Oct. 1-Nov. 30....	2		
Dominica (West Indies):				
				Feb. 26-May 7, 1923: Present with several thousand cases (estimated) reported Feb. 26. Reported as alastrim.
Dominican Republic:				
Puerto Plata.....	Dec. 14-30.....	2		
Santo Domingo.....	Dec. 3-16.....			Present.
Do.....	Feb. 28-Mar. 6.....	3		
San Pedro de Macoris.....	Jan. 13-19.....	2		
Ecuador:				
Babahoyo.....	Apr. 1-15.....	1		
Guayaquil.....	Dec. 1-31.....	10		
Do.....	Jan. 1-May 7.....	15		
Egypt:				
Alexandria.....	Feb. 19-May 5.....	2		
Cairo.....	Jan. 29-Feb. 18....	3		
Port Said.....	Jan. 21-27.....	1		
Esthonia:				
				Oct. 1-Dec. 31, 1922: Cases, 61. Jan. 1-Apr. 30, 1923: Cases, 40. Apr. 16-30, 1923: One case.
Finland:				
France:				
Paris.....	Dec. 1-10.....	1		
Do.....	Mar. 4-10.....	1		
Germany:				
Bremen.....	Dec. 3-9.....	1		
Great Britain:				
Liverpool.....	Dec. 11-17.....	1		From vessel.
Do.....	Apr. 22-May 12....	4		From S. S. Oak Branch, from South American ports. May 6-12, 1923: On vessels, of which one from Antwerp, one coastwise.
London.....	Nov. 26-Dec. 23....	3		
Nottingham.....	Nov. 19-Dec. 13....	4		
Do.....	Jan. 7-Apr. 14....	17		

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 30, 1922, to June 29, 1923—Continued.

SMALLPOX—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Greece:				
Kalamata.....	Jan. 13-Feb. 13.....		1	
Patras.....	Jan. 21-Apr. 22.....		112	
Saloniki.....	Nov. 6-Dec. 31.....	6	5	
Do.....	Jan. 15-Apr. 29.....	22	7	
Zante.....				Epidemic, Jan. 17, 1923.
Do.....	Jan. 7-14.....	13	4	
Guadeloupe (West Indies).....				Feb. 26, 1923: Present. Reported as alastrim.
Guatemala:				
Guatemala City.....	Feb. 23.....			Present.
Honduras.....				Apr. 17, 1923: Outbreak in interior.
India.....				Nov. 5-Dec. 30, 1922: Cases, 5,783; deaths, 333. Dec. 31, 1922-Apr. 14, 1923: Cases, 31,473; deaths, 7,442.
Bombay.....	Nov. 5-Dec. 30.....	22	10	
Do.....	Dec. 31-Apr. 21.....	512	231	
Calcutta.....	Nov. 12-Dec. 30.....	46	23	
Do.....	Dec. 31-Apr. 28.....	198	102	
Karachi.....	Nov. 26-Dec. 30.....	6		
Do.....	Dec. 31-May 7.....	89	38	
Madras.....	Nov. 12-Dec. 30.....	71	23	
Do.....	Dec. 31-May 12.....	373	122	
Rangoon.....	Nov. 5-Dec. 30.....	27	6	
Do.....	Jan. 7-May 5.....	554	238	
Iraq (Mesopotamia):				
Bagdad.....	Oct. 1-Nov. 30.....	568	361	
Do.....	Jan. 1-Mar. 31.....	38	50	
Italy:				
Catania.....	Apr. 16-22.....	1		
Turin.....	Jan. 29-Apr. 29.....	24		
Genoa.....	Apr. 1-10.....	1		From vessel.
Jamaica.....				Dec. 31, 1922-May 26, 1923: Cases, 913. Previously recorded as alastrim.
Kingston.....	Mar. 11-May 26.....	20		
Japan:				
Kobe.....	Jan. 13-May 18.....	9	2	
Nagasaki.....	Apr. 30-May 6.....	1		
Taiwan Island.....	Mar. 1-10.....	1	1	
Yokohama.....	Jan. 22-Mar. 23.....	2		
Java:				
East Java—				
Soerabaya.....	Nov. 5-11.....	4		
Do.....	Feb. 4-Apr. 21.....	39	5	
West Java—				
Batavia.....	Nov. 11-Dec. 22.....	25	1	City and Province.
Do.....	Jan. 27-May 4.....	84	12	Province.
Latvia.....				Oct. 1-Dec. 31, 1922: Cases, 7. Mar. 1-31, 1923: Cases, 5.
Martinique.....				Mar. 25-Apr. 21, 1923: Present. Reported as alastrim.
Fort de France.....	Mar. 25-Apr. 21.....			Present.
Mexico:				
Chihuahua.....	Dec. 4-17.....		4	
Do.....	Jan. 1-May 27.....	81	30	
Guadalajara.....	Dec. 1-31.....	4		
Do.....	Jan. 1-Apr. 30.....	129	47	
Mexico City.....	Nov. 12-Dec. 23.....	43		Including municipalities in Federal District.
Do.....	Dec. 31-May 19.....	466		Do.
Nogales.....	Dec. 10-19.....		1	
Do.....	Dec. 31-Feb. 10.....		2	
Saltillo.....	Jan. 28-Feb. 3.....	1		
San Luis Potosi.....	Jan. 14-20.....	1		
Do.....	Apr. 20-May 19.....		2	
Sonora, State.....				Nov. 1-30, 1922: Present in northern section.
Empalme.....	Nov. 1-30.....	4	1	
Tabasco, State.....				Present in some localities, Mar. 26, 1923.
Torreón.....	Dec. 1-31.....		1	
Vera Cruz.....	Feb. 26-June 3.....	12	7	
Palestine.....				Jan. 23-Feb. 19, 1923: Cases, 8; northern district.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 30, 1922, to June 29, 1923—Continued.

SMALLPOX—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Persia:				
Tabriz.....	Dec. 18-31.....		2	
Do.....	Jan. 15-Feb. 28.....		5	
Teheran.....	Oct. 24-Dec. 22.....	139		
Do.....	Dec. 20-Mar. 31.....	59		
Peru.....				Feb. 1-23, 1923: Cases, 8; deaths, 1.
Callao.....	Nov. 1-15.....	2		
Lima (city).....	Dec. 1-15.....	3	1	
Do.....	Mar. 1-31.....	2	2	
Lima (country).....	Nov. 1-15.....	2	1	
Do.....	Feb. 16-28.....	2		
Poland.....				City and country.
				Oct. 1-Dec. 23, 1922: Cases, 132; deaths, 26. Jan. 1-Mar. 3, 1923: Cases, 114; deaths, 22.
Portugal:				
Lisbon.....	Nov. 19-Dec. 30.....	143	34	
Do.....	Dec. 31-May 12.....	87	88	
Oporto.....	Oct. 15-Dec. 30.....	24	12	
Do.....	Dec. 31-June 2.....	23	12	Dec. 25-31, 1922: Deaths, 12. Mar. 26-May 19, 1923: Cases, 107; deaths, 28.
Portuguese West Africa:				Jan. 5-20, 1923: Cases, 22; deaths 6.
Angola—				
Loanda.....	Oct. 27-Nov. 11.....		10	
Rumania:				
Bucharest.....	Feb. 1-10.....	1		
Chisinau.....	Jan. 1-Feb. 23.....	26		
Galatz.....	Feb. 1-10.....	2		
Russia:				
City—				
Moscow.....				Jan. 1-31, 1923: Cases treated in hospital, 10.
Province—				Jan.-Sept. 1922: Cases, 8,744.
Ukraine.....				Present.
St. Lucia Island.....	Apr. 26.....			
Siam:				
Bangkok.....	Apr. 22-23.....	5	1	
Siberia:				
Vladivostok.....	Mar. 1-31.....	1		Present in Nikolsk, Slassk, and Ussurisk Counties.
Sierra Leone:				
Freetown.....	Feb. 16-23.....	1		
Koinadugu.....	Apr. 1-30.....	8		District.
Society Islands:				
Tahiti.....	May 13-26.....	1	1	
Spain:				
Corunna.....	Nov. 26-Dec. 2.....		1	
Huelva.....	Nov. 24-Dec. 31.....		4	
Madrid.....	Dec. 1-31.....		1	
Do.....	Jan. 1-31.....		1	
Seville.....	Nov. 27-Dec. 31.....		32	
Do.....	Jan. 1-Mar. 11.....		16	
Valencia.....	Nov. 26-Dec. 23.....	3		
Do.....	Dec. 31-May 28.....	93	5	
Straits Settlements:				
Singapore.....	Apr. 22-23.....	1		
Switzerland:				
Basel.....	Feb. 23-Apr. 19.....	9		
Berne.....	Nov. 19-Dec. 30.....	85		
Do.....	Dec. 31-May 12.....	194		
Lucerne.....	Jan. 1-Mar. 31.....	22		
Zurich.....	Nov. 19-Dec. 30.....	19		
Do.....	Jan. 14-May 19.....	75		
Syria:				
Aleppo.....	Nov. 19-Dec. 23.....	38	20	
Do.....	Dec. 31-Apr. 14.....	30	6	
Beirut.....	Dec. 11-20.....	1		
Do.....	Apr. 11-20.....	1		
Damascus.....	Nov. 1-Dec. 31.....	97	16	
Do.....	Jan. 1-May 1.....	28		
Tunis:				
Tunis.....	Dec. 1-22.....	2	1	
Do.....	Jan. 22-Feb. 4.....	1	1	
Turkey:				
Constantinople.....	Nov. 19-Dec. 16.....	122	34	
Do.....	Dec. 31-May 5.....	416	496	Apr. 21-27, 1923: Many cases reported.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 30, 1922, to June 29, 1923—Continued.

SMALLPOX—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Union of South Africa.....				Oct. 1-Dec. 31, 1922: Cases—Colored, 64; deaths, 1; white, cases, 4.
Do.....				Jan. 1-Mar. 31, 1923: Cases, 54; colored, 31; white, 4; deaths, 3 (colored).
Cape Province.....				Oct. 1-Dec. 31, 1922: Cases—Colored, 48; deaths, 1; white, 4 cases.
Do.....				Jan. 1-Mar. 31, 1923: Cases 36 (colored, 18; white, 4). Deaths, colored, 2.
Do.....	Dec. 31-Apr. 21			Outbreaks.
East London.....	Jan. 7-13	2		
Natal.....				Dec. 1-31, 1922: Cases, 6 (colored).
Do.....				Jan. 1-Feb. 28, 1923: Cases, 7; deaths, 1 (colored).
Do.....	Feb. 4-10			Outbreaks.
Orange Free State.....				Dec. 1-31, 1922: Cases, 2 (colored).
Do.....				Jan. 1-31, 1923: Cases, 3 (colored).
Do.....	Jan. 14-Feb. 3			Outbreaks.
Southern Rhodesia.....	Nov. 9-15	3		
Transvaal.....				Oct. 1-Dec. 31, 1922: Cases, 10.
Do.....				Jan. 1-Mar. 31, 1923: Cases, 12 (colored); deaths, 1.
Do.....	Dec. 31-Apr. 15			Outbreaks.
Johannesburg.....	Nov. 1-30		1	
Do.....	Jan. 1-31	1		
Uruguay:				
Montevideo.....	do.	8		
Yugoslavia.....				Aug. 1-31, 1922: Cases, 30; deaths, 12.
Do.....				Dec. 31, 1922-Mar. 24, 1923: Cases, 567; deaths, 100.
Bosnia-Herzegovina.....				Dec. 31, 1922-Mar. 24, 1923: Cases, 266; deaths, 35.
Croatia—				
Zagreb.....	Apr. 1-7	1		
Serbia.....				Aug. 1-31, 1922: Cases, 26. Dec.
Belgrade.....	Nov. 12-Dec. 31	10	4	31-Mar. 24, 1923: Cases, 70; deaths, 21.
Do.....	Mar. 18-Apr. 28	2	2	
On vessels:				
S. S. Bahia.....	Mar. 4-10	1		At Pernambuco, Brazil.
S. S. Craftsman.....	May 6-12	1		At Liverpool from Antwerp. Left May 19, for Glasgow; left May 25, for San Francisco.
S. S. Hedsley.....	do.	1		At Liverpool. Coastwise.
S. S. Huntress.....	Nov. 11	1		At Fremantle, Australia; from Cape Town, South Africa.
S. S. Junin.....	Jan. 13	1		At Antofagasta, Chile. Vessel proceeded to Arica, Chile, with patient on board.
S. S. —.....	Dec. 17-23	1		At Liverpool.
S. S. Oak Branch.....	Apr. 22-28	2		At Liverpool from South American ports. (Iquique, Chile, Mar. 17; Balboa, Apr. 1, 1923.)
S. S. Tenyo Maru.....	Mar. 20	1		At Shanghai, China, from Japan. In steerage passenger.

TYPHUS FEVER.

Africa:				
Algeria:				
Algiers.....	Nov. 11-Dec. 31	2	1	
Do.....	Jan. 1-Apr. 30	76	25	
Oran.....	Jan. 11-20	1	1	
Austria:				
Vienna.....	Jan. 7-17	1		
Bolivia:				
La Paz.....	Jan. 1-Mar. 31	31	24	
Brazil:				
Pernambuco.....	Dec. 3-9	2	2	
Porto Alegre.....	Nov. 19-Dec. 16	3		
Do.....	Feb. 25-Mar. 3		3	
Bulgaria:				
Sofia.....	Feb. 4-Apr. 14	7		Paratyphus, 4 cases; 1 death

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 30, 1922, to June 29, 1923—Continued.

TYPHUS FEVER—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Chile:				
Antofagasta.....	Nov. 12-Dec. 30...	24	5	Nov. 11-Dec. 5, 1922: Cases, 10; deaths, 2. Quarantine station: October, 1922—1 fatal case on vessel from Valparaiso; November, 1922—cases, 7; December, 1922—cases, 9; remaining, Dec. 31, 3 cases.
Do.....	Dec. 31-Apr. 7.....	4	2	
Concepcion.....	Oct. 17-Dec. 18.....		9	
Do.....	Dec. 26-Apr. 23.....		16	Apr. 1-30, 1923: Deaths, 4.
Iquique.....	Jan. 14-Mar. 31.....		3	
Talcahuano.....	Nov. 12-Dec. 23.....	10	6	
Do.....	Jan. 7-May 12.....	10	3	
Valparaiso.....	Dec. 3-30.....		9	
Do.....	Dec. 31-May 12.....		56	Daily hospital average, reported Feb. 16, 1923, 25 cases.
China:				
Antung.....	Nov. 13-Dec. 10.....	7		
Do.....	Apr. 2-May 13.....	12		
Hankow.....	May 13-19.....	1		
Manchuria—				
Harbin.....	Nov. 20-26.....	7		
Do.....	Jan. 1-May 6.....	9		
Cuba:				
Matanzas.....	Dec. 25-31.....	1	1	
Czechoslovakia:				Jan. 1-Feb. 28, 1923: Cases, 121; deaths, 5.
City—				
Prague.....	Nov. 19-25.....	1		
Province—				
Bohemia.....	Nov. 1-30.....	1		
Russia.....	Oct. 1-Dec. 31.....	25		
Slovakia.....	Nov. 1-30.....	2		
Danzig (Free City).....	Jan. 7-Feb. 24.....	2		Including 1 from Poland.
Egypt:				
Alexandria.....	Nov. 19-Dec. 31.....	2	1	
Do.....	Jan. 22-May 13.....	14	6	Imported, 2.
Cairo.....	Oct. 1-Dec. 31.....	19	9	
Do.....	Jan. 1-Mar. 11.....	13	6	Feb. 26-Mar. 4, 1923: One case relapsing fever.
Port Said.....	Mar. 25-May 26.....	3		Oct. 1-Dec. 31, 1922: Cases, 6. Recurrent typhus: Cases, 10. Year 1922: Cases, 159; recurrent typhus, 91 cases.
Estonia:				
Do.....				Jan. 1-Apr. 30, 1923: Cases, 24. Recurrent typhus, Jan. 1-31, cases, 4. Paratyphus, Apr. 1-30, 1923: Cases, 6.
Liban.....	Dec. 24-30.....	1		Year 1922: Cases, 140. Recurrent typhus: Cases, 83.
Narva.....				Feb. 16-Mar. 15, 1923: Cases, 7; recurrent typhus, 1.
Finland:				
Do.....	Apr. 16-30.....	3		
France:				
Marseille.....	Mar. 1-31.....		1	
Germany:				
Berlin.....	Nov. 25-Dec. 2.....		1	
Coblenz.....	Dec. 10-16.....	1		
Do.....	Mar. 25-31.....	1		
Dresden.....	Dec. 10-16.....	1		
Königsberg.....	Mar. 24-Apr. 7.....	2		
Great Britain:				
Glasgow.....	Jan. 7-Feb. 17.....	4	1	
Greece:				
Athens.....	Mar. 1-Apr. 30.....		9	
Corfu Island.....	Feb. 8.....			Present.
Leucadia.....	Jan. 17.....			Do.
Patras.....	Nov. 19-25.....		1	
Do.....	Jan. 1-Apr. 22.....	3	32	
Piræus.....	Jan. 17.....			Jan. 13-Mar. 31, 1923: Deaths, 12. Present.
Provesa.....	Jan. 17.....			Among refugees.
Saloniki.....	Dec. 18-24.....			Refugees. Recurrent typhus fever, Mar. 12-Apr. 1, 1923. Cases, 4; deaths, 1.
Do.....	Jan. 7-Apr. 29.....	124	12	Present.
Zante.....	Jan. 17.....			
Guatemala:				
Guatemala City.....	Jan. 1-31.....		1	

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 30, 1922, to June 29, 1923—Continued.

TYPHUS FEVER—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Hungary:				
Budapest.....	Jan. 14-May 12....	44	12	
Iraq (Mesopotamia):				
Bagdad.....	Feb. 1-Mar. 31....	2		
Ireland:				
Belmullet.....	June 15-Dec. 14....	20		In County Mayo.
Italy:				
Catania.....	May 7-13.....	1		
Trieste.....	Feb. 25-Mar. 3....	1		
Latvia.....				Oct. 1-Dec. 31, 1922: Cases, 74. Recurrent typhus: Cases, 10. Feb. 1-Mar. 31, 1923: Cases, 93. Recurrent typhus, 2 cases; paratyphus, 2 cases.
Libau.....	Apr. 25-May 1....	2		
Mexico:				
Guadalajara.....	Mar. 1-Apr. 30....	2	1	
Mexico City.....	Nov. 12-Dec. 30....	90		Including municipalities in Federal District.
Do.....	Dec. 31-May 19....	233		Do.
San Luis Potosi.....	Jan. 28-May 26....		5	
Netherlands:				
Rotterdam.....	Apr. 29-May 12....	3		
Palestine.....				Dec. 5-25, 1922: Cases, 3; in northern section. Feb. 27-Mar. 5, 1923—1 case in northern section. Apr. 17-23, 1923: One case relapsing fever.
Jaffa.....	Dec. 12-18.....	2		
Do.....	Jan. 16-May 7....	10		
Jerusalem.....	Dec. 26-Jan. 1....	1		
Sannaria.....	Apr. 24-30.....	1		
Paraguay:				
Asuncion.....	Jan. 1-27.....		1	
Persia:				
Tabriz.....	Dec. 18-31.....		3	
Do.....	Jan. 15-28.....		1	
Teheran.....	Sept. 24-Nov. 24....		3	
Do.....	Feb. 13-May 31....		6	
Poland.....				Oct. 1-Dec. 23, 1922: Cases, 1,916; deaths, 130. Recurrent typhus: Cases, 2,071; deaths, 56. Jan. 1-Mar. 3, 1923: Cases, 3,517; deaths, 278. Recurrent typhus: Cases, 897; deaths, 22.
Portugal:				
Lisbon.....	Mar. 26-Apr. 1....		1	
Oporto.....	Oct. 15-Dec. 2....	1	1	
Do.....	Mar. 11-May 23....	16	2	
Rumania:				
Bucharest.....				To Jan. 31, 1923: Cases, 96; deaths, 13.
Do.....	Feb. 1-10.....	133		
Chisinau.....	Nov. 1-30.....	5		
Do.....	Jan. 1-Feb. 28....	110		Recurrent typhus: Cases, 33.
Craiova.....	Feb. 1-10.....	1		
Kishineff.....	Apr. 1-30.....	16		District.
Russia.....				July 29-Sept. 23, 1922: Cases, 23,803.
Moscow.....	Jan. 1-31.....	290		Undetermined cases, 38.
Ukraine.....	Jan.-Sept.....	307,322		Provisional figures.
Ukraine, Tartar Republic, and Siberia.....	June 1-30.....	35,926		
Do.....	July 1-31.....	17,262		Do.
Do.....	Aug. 1-31.....	6,864		Do.
Do.....	Sept. 1-30.....	2,388		Do.
Siberia:				
Vladivostok.....	Nov. 1-Dec. 31....	5		Remittent, 1 case; indefinite, 6.
Do.....	Jan. 1-Mar. 31....	215		Remittent, 1 case; indefinite, 33.
Spain:				
Barcelona.....	Nov. 30-Dec. 27....		3	
Do.....	Jan. 11-Mar. 28....		2	
Madrid.....	Dec. 1-31.....		1	
Do.....	Feb. 1-28.....		1	
Syria:				
Aleppo.....	Dec. 10-16.....	1	1	
Do.....	Jan. 7-May 19....	117	24	Generally among refugees.
Beirut.....	Oct. 1-22.....	1		
Do.....	Mar. 1-Apr. 20....	85		
Tunis:				
Tunis.....	Apr. 16-May 13....	1	1	

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 30, 1922, to June 29, 1923.—Continued.

TYPHUS FEVER—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Turkey:				
Constantinople.....	Nov. 27-Dec. 2.....	3		Mar. 31-Apr. 6, 1923: Many cases reported.
Do.....	Dec. 31-May 12.....	199	371	Oct. 1-Dec. 31, 1922: Colored—cases, 3,097; deaths, 298; white—cases, 11; deaths, 2.
Union of South Africa.....				Jan. 1-Mar. 31, 1923: Total cases, 1,253; deaths, 111. (Colored—cases, 1,238; deaths, 110; white—cases, 15; 1 death.)
Do.....				Oct. 1-Dec. 31, 1922: Colored—cases, 2,799; deaths, 250; white—cases, 5; death, 1.
Cape Province.....				Jan. 1-Mar. 31, 1923: Colored—cases, 1,000; deaths, 79; white—9 cases, 1 death.
Do.....				Outbreaks.
Do.....	Dec. 31-Apr. 21.....			Oct. 1-Dec. 31, 1922: Colored—cases, 143; deaths, 32; white—cases, 2.
Port Elizabeth.....	Jan. 28-Feb. 10.....	3		Jan. 1-Mar. 31, 1923: Colored—cases, 53; deaths, 10; white—1 case.
Natal.....				Outbreaks.
Do.....				Oct. 1-Dec. 31, 1922: Colored—cases, 91; deaths, 8; white—cases, 3; deaths, 1.
Do.....	Feb. 4-Apr. 14.....			Jan. 1-Mar. 31, 1923: Colored—cases, 120; deaths, 11; white—2 cases.
Orange Free State.....				Outbreaks.
Do.....				Oct. 1-Dec. 31, 1922: Colored—cases, 64; deaths, 8.
Do.....	Jan. 7-Apr. 28.....			Jan. 1-Mar. 31, 1923: Colored—cases, 65; deaths, 11; white—cases, 2.
Transvaal.....				Outbreaks.
Do.....	Jan. 14-Mar. 17.....			Oct. 1-Dec. 31, 1922: Colored—cases, 64; deaths, 8.
Johannesburg.....	Nov. 1-30.....	3	6	Jan. 1-Mar. 31, 1923: Colored—cases, 65; deaths, 11; white—cases, 2.
Do.....	Jan. 1-Feb. 28.....	38	8	Outbreaks.
Venezuela:				
Maracaibo.....	Jan. 21-May 19.....		2	Oct. 1-Dec. 31, 1922: Colored—cases, 64; deaths, 8.
Yugoslavia:				Jan. 1-Mar. 31, 1923: Colored—cases, 65; deaths, 11; white—cases, 2.
Bosnia-Herzegovina.....	Aug. 1-31.....	1		Outbreaks.
Do.....	Dec. 31-Mar. 24.....	51		Oct. 1-Dec. 31, 1922: Colored—cases, 64; deaths, 8.
Croatia—				Jan. 1-Mar. 31, 1923: Colored—cases, 65; deaths, 11; white—cases, 2.
Zagreb.....	Apr. 1-28.....	3		Outbreaks.
Serbia.....				Oct. 1-Dec. 31, 1922: Colored—cases, 64; deaths, 8.
Belgrade.....	Mar. 18-May 5.....	10		Jan. 1-Mar. 31, 1923: Colored—cases, 65; deaths, 11; white—cases, 2.

YELLOW FEVER.

Brazil:				
Bahia.....	Dec. 31-May 12.....	113	33	
Colombia:				
Bucaramanga.....	May 3-19.....	39	2	Outbreak of epidemic reported Mar. 12, 1923; information showing diagnosis of yellow fever received under date of May 16, 1923. Declared epidemic by Colombian Government May 20, 1923.
Mexico:				
Ciudad Victoria.....	Dec. 17-23.....	1		
Tampico.....	Jan. 15.....	1		Reported on bills of health.
West Africa:				
Gold Coast—				
Saltpond.....				Reported present Dec. 21, 1922.
Nigeria—				
Warrai.....				Do.

INDEX.

A.

Page.

Abortion—Produced in a cow by inoculation with bacterium melitensis—	
Evans.....	825
Acids.—Penetration of, into living and dead cells—Brooks.....	1449, 1470
Alabama:	
(See also Summaries—Disease cases reported monthly by States.)	
Anniston—Dengue.....	973
Current State morbidity summaries.....	19,
68, 106, 148, 204, 255, 303, 352, 408, 462, 518, 629, 690, 743, 790, 842,	
895, 968, 1026, 1090, 1146, 1278, 1358, 1361, 1411, 1483.	
Summary of diseases—	
October, November, December, 1922.....	567
January, February, March, 1923.....	1324
Alastrim:	
(See also Smallpox.)	
Jamaica.....	85, 171, 275, 372, 482, 651, 712
St. Thomas Parish.....	85
West Indies—	
Dominica.....	174
Guadeloupe—Basse Terre.....	174, 224
Alkali bicarbonates—Penetration of, into living and dead cells—Brooks..	1449, 1470
Alum:	
Indicators for pH control of dosage—Cohen.....	739
Relation of hydrogen ion concentrations to formation of floc in solutions—	
Theriault and Clark.....	181
American seamen—Incidence of venereal diseases among, in the Orient—King.	1477
Anaerobe—Toxin-producing, isolated from fly larvæ—Relation to B. botu-	
linius—Bengtson	340
Anthrax:	
Australia—	
Albury.....	809
New South Wales.....	916
California—Eureka.....	1094
City reports for week ended—	
December 16, 1922.....	23
December 23, 1922.....	72
December 30, 1922.....	111
January 6, 1923.....	154
February 3, 1923.....	356
February 10, 1923.....	412
February 17, 1923.....	466
March 17, 1923.....	747
March 24, 1923.....	795
March 31, 1923.....	847
April 14, 1923.....	972
April 28, 1923.....	1094
May 5, 1923.....	1152
May 26, 1923.....	1362
June 9, 1923.....	1487
Czechoslovakia.....	323, 1046, 1223
Illinois—Chicago.....	1487
India—	
Burma.....	171
Madras Presidency.....	171

	Page.
Anthrax—Continued.	
Massachusetts—Webster.....	1362
Pennsylvania—Philadelphia.....	23, 72, 111
Russia—Lettonia.....	127
State morbidity reports—	
October, November, December, 1922.....	538
January, February, March, 1923.....	1293
Union of South Africa—Cape Province.....	652
West Virginia—Huntington.....	356
Antitoxin—Diphtheria—Necessity for using urged by State health commis- sioners.....	837
Argentina—Rosario—Plague (human).....	809
Arizona:	
(See also Summaries—Disease cases reported monthly by States.)	
Current State morbidity summaries.....	629,
690, 743, 790, 842, 895, 968, 1026, 1090, 1146, 1204, 1275, 1358, 1411, 1483	
Summary of diseases—January, February, March, 1923.....	1324
Arkansas:	
(See also Summaries—Disease cases reported monthly by States.)	
Court decision—Local registrars held to be county employees.....	1356
Current State morbidity summaries.....	19,
68, 106, 149, 204, 255, 303, 352, 408, 462, 518, 629, 690, 743, 790, 842,	
895, 968, 1027, 1090, 1146, 1204, 1275, 1358, 1411, 1483.	
Summary of diseases—	
October, November, December, 1922.....	567
January, February, March, 1923.....	1324
Arsenic—Penetration of, into cerebrospinal fluids—Treatment of protozoal infections of central nervous system—Voegtlin, Smith, Dyer, and Thompson	1003
Arsphenamine—Parasitocidal values of, and neoarsphenamine in "arsenic fast" strains of trypanosomes—Lake and Probey.....	1347
Australia:	
Albury—Anthrax.....	809
Declared free from plague.....	987
New South Wales—	
Anthrax.....	916
Tick eradication—Compulsory dipping of cattle.....	916
Thursday Island quarantine—Plague (human).....	372
Austria—Vienna—Births and deaths, 1910-1922.....	1501
Azores:	
Castelo Branco—Island of Fayal—Plague (human).....	223, 809
St. Michaels Island—Plague (human).....	169, 650, 809, 1376
B.	
Bacillus coli—Movement in ground water, and pollution of wells—Stiles and Crohurst.....	1350
Bacterium melitensis—Abortion in a cow produced by inoculation with— Evans.....	825
Bagby, B. B.—Changes in a town brought about by the health department....	456
Bengtson, Ida A.—Toxin-producing anaerobe isolated from fly larvæ—Relation to B. botulinus.....	340
Birth and mortality rates:	
Bureau of the Census compilation—	
Provisional figures, first nine months, 1922.....	513
Provisional figures, year 1922.....	1353
England and Wales—1922, and first quarter 1923.....	1407
Births and birth rates—Provisional figures, first six months, 1922—Bureau of the Census compilation.....	13
Blackwater fever—Mexico—Tuxtepec.....	811
Body weight and longevity.....	1271
Bolivia—La Paz—Mortality, 1922.....	710
Boric acid—Liquid eggs, source of, in cake—England.....	512
Brazil:	
Bahia—	
Plague (human).....	1431
Yellow fever.....	428, 650, 710, 763, 809, 862, 1431

Page.		Page.
1362	Brazil—Continued.	
111	Manaos—	
127	Leprosy.....	36
	Malaria.....	36
538	Nichteroy—Dengue.....	862
1293	Para—Leprosy.....	322
652	Pernambuco—Recife—Mortality, 1911-1922.....	1431
356	Rio de Janeiro—Dengue.....	862, 1330
	British West Indies—Trinidad:	
	Influenza.....	1505
837	Quarantine imposed against Martinique—Occurrence of alastrim.....	1110
809	Brooks, Matilda Moldenhauer—Permeability of living and dead cells:	
	1. Penetration of acids into.....	1449
	2. Penetration of alkali bicarbonates into.....	1470
629,	Bulgaria—Sofia—Lethargic encephalitis.....	650, 763
1483		
1324	C.	
	Cake—Liquid eggs source of boric acid in—England.....	512
1356	California:	
19,	(See also Summaries—Disease cases reported monthly by States.)	
842,	Contra Costa County—Alamo—Plague (rodent)—Infected ground squirrels	
	found.....	1416
567	Current State morbidity summaries.....	19,
1324	68, 106, 148, 204, 255, 303, 352, 408, 462, 518, 629, 690, 743, 790, 842,	
	895, 968, 1026, 1090, 1146, 1275, 1278, 1358, 1411, 1483.	
1003	Eureka—Anthrax.....	1094
	Los Angeles—	
	Leprosy.....	850, 1419
1347	Rabies in man.....	639, 1283, 1366
	Typhus fever.....	29
809	Sacramento—Leprosy.....	636
987	San Bernardino—Rabies in man.....	1421
	San Francisco—	
916	Leprosy.....	309, 415, 1209, 1419, 1489
916	Lethargic encephalitis.....	1209
372	San Pedro—Smallpox on S. S. <i>Ryder Hanify</i> arriving from Portland, Oreg..	1417
1501	Summary of diseases—	
	October, November, December, 1922.....	567
809	January, February, March, 1923.....	1324
1376	Canada:	
	British Columbia—Vancouver—Lethargic encephalitis.....	574
	Dalhousie Junction—Lethargic encephalitis.....	862
	Decrease in mortality from tuberculosis.....	1501
	Manitoba—Winnipeg—Lethargic encephalitis.....	574, 862, 1222, 1330
1350	North Bay—Typhoid fever.....	863
	Ontario—	
825	Cochrane—Typhoid fever.....	763, 810, 863
456	Communicable diseases.....	36, 169, 322, 574, 710, 862, 1108, 1432
	Venereal diseases.....	36, 169
340	Saskatchewan—Regina—Lethargic encephalitis.....	810
	Vancouver—Lethargic encephalitis.....	987
	Canary Islands:	
513	Plague (human)—January-March, 1923.....	916, 1108
1353	Plague (rodent)—February, March, 1923.....	916
1407	Cats—Plague-infected found—On vessel arriving at London, England, from	
	South America.....	372
13	Cattle—Compulsory dipping for eradication of tick—Australia—New South	
811	Wales.....	916
1271	Celebes (Malay Archipelago)—Macassar—Plague (human).....	810
710	Cells—Permeability of living and dead:	
512	1. Observations on the penetration of acids into—Brooks.....	1449
	2. Observations on the penetration of alkali bicarbonates into—Brooks....	1470
1431	Cerebrospinal fluid—Penetration of arsenic into—Voegtlin, Smith, Dyer, and	
1431	Thompson.....	1003

Cerebrospinal meningitis:	
(See also Meningitis.)	
(See also Summaries—Disease cases reported monthly by States.)	
City reports for week ended—	Page.
December 16, 1922.....	23
December 23, 1922.....	72
December 30, 1922.....	111
January 6, 1923.....	155
January 13, 1923.....	208
January 20, 1923.....	260
January 27, 1923.....	307
February 3, 1923.....	357
February 10, 1923.....	413
February 17, 1923.....	466
February 24, 1923.....	524
March 3, 1923.....	633
March 10, 1923.....	694
March 17, 1923.....	747
March 24, 1923.....	795
March 31, 1923.....	848
April 7, 1923.....	902
April 14, 1923.....	972
April 21, 1923.....	1030
April 28, 1923.....	1094
May 5, 1923.....	1152
May 12, 1923.....	1208
May 19, 1923.....	1280
May 26, 1923.....	1362
June 2, 1923.....	1418
June 9, 1923.....	1488
Greece.....	223
Japan—Taiwan Island.....	919, 1047
Mexico—Frontera.....	988
State morbidity reports—	
October, November, December, 1922.....	539
January, February, March, 1923.....	1293
Children:	
Heights and weights as an index of nutrition—Clark, Sydenstricker, Collins.	39
School—	
Free dental dispensary for destitute—Cienfuegos, Cuba.....	142
Health scoring of—Clark and Lowry.....	285
Physical care of, in rural districts—Clark.....	1181
Chile:	
Antofagasta—	
Report of infectious diseases treated at hospital.....	710
Typhus fever.....	169
Concepcion—Mortality—	
February, 1923.....	916
March, 1923.....	1222
April, 1923.....	1330
Nitrate regions—Typhus fever.....	169
Valparaiso—	
Smallpox.....	372, 650
Typhus fever.....	650
China—Liutaoku—Cholera.....	125
Cholera:	
China—Liutaoku.....	125
Foreign reports—	
Cumulative table.....	88, 132, 176, 227, 278, 327, 376, 429, 485, 579, 656, 716, 768, 816, 866, 923, 992, 1049, 1113, 1169, 1227, 1333, 1379, 1436, 1507
Weekly table.....	37, 87, 129, 174, 225, 277, 325, 374, 429, 583, 577, 653, 714, 766, 814, 864, 920, 990, 1048, 1111, 1168, 1225, 1332, 1378, 1434, 1005
India—Calcutta.....	125, 1224
Russia.....	127
Clark, Taliaferro:	
Health scoring of school children.....	285
Indices of nutrition.....	1239
Physical care of rural school children.....	1181

	Page.
Clark, Taliaferro—Continued.	
Trachoma problem in the State of Minnesota.....	383
Weight and height as an index of nutrition.....	39
Clark, W. Mansfield:	
Oxidation-reduction—	
1. Introduction.....	443
2. Relations between reduction potentials and pH.....	666
3. Electrode potentials of a new indophenol.....	933
Pasteur—An appreciation.....	91
Relation of hydrogen ion concentrations to formation of floc in alum solutions.....	181
Cohen, Barnett:	
Indicators for pH control of alum dosage.....	739
Oxidation-reduction—	
2. Relations between reduction potentials and pH.....	666
3. Electrode potentials of a new indophenol.....	933
Some new sulfonphthalein indicators.....	199
Collins, Selwyn D.:	
Indices of nutrition.....	1239
Weights and heights as an index of nutrition.....	39
Colombia:	
Bucaramanga—	
Epidemic disease (undetermined).....	650, 917, 1044
Malaria—Pernicious.....	917, 1044
Weil's disease.....	917, 1044
Yellow fever.....	1222, 1376
Buenaventura—Smallpox.....	322
Santa Marta—Smallpox.....	917
Colorado:	
(See also Summaries—Disease cases reported monthly by States.)	
Current State morbidity summaries.....	19,
68, 106, 148, 204, 255, 303, 352, 408, 462, 518, 629, 690, 743, 790, 842,	
895, 968, 1026, 1090, 1146, 1204, 1275, 1358, 1411, 1483.	
Summary of diseases—	
October, November, December, 1922.....	567
January, February, March, 1923.....	1325
Communicable diseases:	
(See also Epidemic diseases; Infectious diseases.)	
Canada—Ontario.....	36, 169, 322, 574, 710, 862, 1108, 1331, 1432
Case rates per 1,000 population—From monthly reports of State health officers—	
November, 1922.....	154
December, 1922.....	523
January, 1923.....	846
February, 1923.....	900
March, 1923.....	1151
April, 1923.....	1416
Cases of, reported by State health officers monthly—	
November, 1922.....	153
December, 1922.....	522
January, 1923.....	846
February, 1923.....	899
March, 1923.....	1150
April, 1923.....	1415
Cuba—	
Habana.....	85,
170, 223, 275, 322, 428, 575, 711, 763, 918, 1045, 1108, 1166, 1330, 1432	
Provinces.....	323, 428, 575, 651, 918, 1376
Czechoslovakia.....	170, 323, 1046, 1223
Esthonia.....	127, 576, 711, 918, 1223, 1502
Finland.....	764
Foreign and insular—Weekly and cumulative tables.....	37,
85, 125, 169, 223, 275, 322, 374, 429, 483, 577, 653, 714, 766, 814, 864, 920,	
990, 1048, 1111, 1168, 1225, 1332, 1378, 1434, 1505.	
Latvia.....	651, 652, 1109, 1331
Panama Canal.....	172, 275, 483, 713, 988
Poland.....	126, 224, 276, 373, 864, 989, 1166, 1504

Communicable diseases—Continued.

	Page.
Russia—	
Estonia.....	127
Lettonia.....	127, 173, 374
Ukraine.....	127
Virgin Islands.....	173, 225, 765, 920, 1225
Yugoslavia.....	324, 1110
Conference:	
Health authorities—Washington, D. C., May 16 and 17, 1923—Program...	1021
State health officers with Public Health Service—Protection of water supplies from phenol wastes—Washington, D. C., May 18, 1923.....	967
Connecticut:	
(See also Summaries—Disease cases reported monthly by States.)	
Current State morbidity summaries.....	19,
68, 106, 148, 204, 255, 303, 352, 408, 462, 518, 629, 690, 743, 791, 842, 895	
968, 1026, 1090, 1146, 1204, 1275, 1358, 1411, 1483.	
New Haven—Typhus fever.....	267
Summary of diseases—	
October, November, December, 1922.....	568
January, February, March, 1923.....	1325
Consumptives—The indigent migratory, in cities of the Southwest—Whitney..	587
Coogle, C. P.—Use of creosote oil as a mosquito repellent.....	437
County health officers—Whole-time—Directory, 1923.....	1081
Court decisions:	
(See also Supreme Court decisions.)	
Arkansas—Local registrars held to be county employees.....	1356
Michigan—Compensation for typhoid fever under workmen's compensation act.....	1272
New Jersey—Sewer connections made by municipality at owner's expense.	1085
New York—Regulation requiring pasteurization of milk.....	98
Ohio—Quarantine for venereal diseases upheld.....	1273
Texas—	
Dallas—Ordinance requiring health certificates of food handlers upheld.....	404
Vaccination requirements to be met by pupils upheld.....	1355
Creosote oil—Use of, as a mosquito repellent—Coogle.....	437
Crohurst, Harry R.—Principles underlying the movement of <i>Bacillus coli</i> in ground water.....	1350
Cuba:	
Cienfuegos—Free dental dispensary for destitute school children.....	142
Habana—Communicable diseases.....	85, 170,
223, 275, 322, 428, 482, 575, 711, 763, 863, 917, 1015, 1108, 1166, 1330, 1432	
Provinces—Communicable diseases.....	323, 428, 482, 575, 651, 810, 817, 1376
Quarantine against ports in United States suspended.....	85
Quarantine against Venezuela on account of plague.....	1377
Quarantine disinfection measures ordered enforced at ports.....	223
Current State morbidity summaries:	
Alabama. (See Alabama—Current State morbidity summaries.)	
Arizona. (See Arizona—Current State morbidity summaries.)	
Arkansas. (See Arkansas—Current State morbidity summaries.)	
California. (See California—Current State morbidity summaries.)	
Colorado. (See Colorado—Current State morbidity summaries.)	
Connecticut. (See Connecticut—Current State morbidity summaries.)	
Delaware. (See Delaware—Current State morbidity summaries.)	
District of Columbia. (See District of Columbia—Current morbidity summaries.)	
Florida. (See Florida—Current State morbidity summaries.)	
Georgia. (See Georgia—Current State morbidity summaries.)	
Illinois. (See Illinois—Current State morbidity summaries.)	
Indiana. (See Indiana—Current State morbidity summaries.)	
Iowa. (See Iowa—Current State morbidity summaries.)	
Kansas. (See Kansas—Current State morbidity summaries.)	
Kentucky. (See Kentucky—Current State morbidity summaries.)	
Louisiana. (See Louisiana—Current State morbidity summaries.)	
Maine. (See Maine—Current State morbidity summaries.)	
Maryland. (See Maryland—Current State morbidity summaries.)	
Massachusetts. (See Massachusetts—Current State morbidity summaries.)	
Michigan. (See Michigan—Current State morbidity summaries.)	

Current State morbidity summaries—Continued.

- Minnesota. (*See* Minnesota—Current State morbidity summaries.)
 Mississippi. (*See* Mississippi—Current State morbidity summaries.)
 Missouri. (*See* Missouri—Current State morbidity summaries.)
 Montana. (*See* Montana—Current State morbidity summaries.)
 Nebraska. (*See* Nebraska—Current State morbidity summaries.)
 New Jersey. (*See* New Jersey—Current State morbidity summaries.)
 New Mexico. (*See* New Mexico—Current State morbidity summaries.)
 New York. (*See* New York—Current State morbidity summaries.)
 North Carolina. (*See* North Carolina—Current State morbidity summaries.)
 North Dakota. (*See* North Dakota—Current State morbidity summaries.)
 Oregon. (*See* Oregon—Current State morbidity summaries.)
 South Dakota. (*See* South Dakota—Current State morbidity summaries.)
 Texas. (*See* Texas—Current State morbidity summaries.)
 Vermont. (*See* Vermont—Current State morbidity summaries.)
 Virginia. (*See* Virginia—Current State morbidity summaries.)
 Washington. (*See* Washington—Current State morbidity summaries.)
 West Virginia. (*See* West Virginia—Current State morbidity summaries.)
 Wisconsin. (*See* Wisconsin—Current State morbidity summaries.)
 Wyoming. (*See* Wyoming—Current State morbidity summaries.)

Czechoslovakia:

Page.

Anthrax.....	323, 1046, 1223
Communicable diseases.....	170, 323, 575, 1046, 1223
Dysentery.....	170, 323, 576, 1223
Malaria.....	170, 323, 1223
Paratyphoid fever.....	323
Rabies in man.....	170, 323, 576, 1046, 1223

D.

Danzig (Free City)—Typhus fever..... 810

Death rates—In a group of insured persons—Compilation of Metropolitan Life

Insurance Co.:

Comparison of, for principal causes..... 65, 145, 347, 786, 1141, 1201, 1480

Principal causes compared and mortality by age groups..... 1141

Deaths:

From pneumonia, tuberculosis, and typhoid fever—In 43 large cities..... 142

Influenza and pneumonia combined, in large cities..... 100

United States—Large cities—Week ended—

December 23, 1922.....	17
December 30, 1922.....	66
January 6, 1923.....	102
January 13, 1923.....	146
January 20, 1923.....	202
January 27, 1923.....	253
February 3, 1923.....	301
February 10, 1923.....	350
February 17, 1923.....	405
February 24, 1923.....	460
March 3, 1923.....	516
March 10, 1923.....	627
March 17, 1923.....	688
March 24, 1923.....	741
March 31, 1923.....	787
April 7, 1923.....	840
April 14, 1923.....	893
April 21, 1923.....	966
April 28, 1923.....	1023
May 5, 1923.....	1088
May 12, 1923.....	1141
May 19, 1923.....	1202
May 26, 1923.....	1273
June 2, 1923.....	1356
June 9, 1923.....	1409
June 16, 1923.....	1481

United States registration area—Principal causes of, 1921—Bureau of the Census compilation..... 11

	Page.
Deaths and death rates—Provisional figures, 1922—Bureau of the Census compilation.....	15
Delaware:	
(See also Summaries—Disease cases reported monthly by States.)	
Current State morbidity summaries.....	19,
106, 205, 256, 304, 352, 409, 691, 1027, 1091, 1359, 1484	
Summary of diseases—	
October, November, December, 1922.....	568
January, February, March, 1923.....	1325
Dengue:	
Alabama—Anniston.....	973
Brazil—	
Nichteroy.....	862
Rio de Janeiro.....	862, 1330
City reports for week ended—	
December 23, 1922.....	73
December 30, 1922.....	111
January 13, 1923.....	209
January 20, 1923.....	260
January 27, 1923.....	308
February 3, 1923.....	357
April 14, 1923.....	973
Louisiana—	
Baton Rouge.....	357
New Orleans.....	111, 209, 260, 308
Dental clinic—Experiments in school—Norway—Trondhjem.....	964
Department of Commerce—Bureau of the Census:	
Census Monograph No. 1—Population changes in the United States, 1910-1920.....	958
Compilation of principal causes of death—United States registration area, 1921.....	11
Compilation of provisional births and birth rates, 1922.....	13
Compilation of provisional deaths and death rates, 1922.....	15
Diphtheria:	
(See also Summaries—Disease cases reported monthly by States.)	
City reports for week ended—	
December 16, 1922.....	30
December 23, 1922.....	78
December 30, 1922.....	117
January 6, 1923.....	161
January 13, 1923.....	215
January 20, 1923.....	268
January 27, 1923.....	314
February 3, 1923.....	364
February 10, 1923.....	420
February 17, 1923.....	474
February 24, 1923.....	531
March 3, 1923.....	642
March 10, 1923.....	702
March 17, 1923.....	755
March 24, 1923.....	802
March 31, 1923.....	855
April, 7, 1923.....	908
April 14, 1923.....	979
April 21, 1923.....	1037
April 28, 1923.....	1100
May 5, 1923.....	1158
May 12, 1923.....	1215
May 19, 1923.....	1285
May 26, 1923.....	1368
June 2, 1923.....	1423
June 9, 1923.....	1494
Necessity for using antotoxin urged by State health commissioners.....	837
Schick tests and immunization against, in Vermont—Kidder.....	663
Directories—Whole-time county health officers—1923.....	1081

District of Columbia:

(See also Summaries—Disease cases reported monthly by States.)

Page.

Current morbidity summaries..... 19, 22, 110,

149, 152, 256, 259, 304, 353, 463, 466, 519, 630, 746, 794, 845

899, 971, 1030, 1093, 1149, 1207, 1278, 1362, 1415, 1484, 1487

Summary of diseases—

October, November, December, 1922..... 568

January, February, March, 1923..... 1325

Tularemia in the market—Francis..... 1391

Dominica (West Indies)—Smallpox (reported as alastrim)..... 811

Dyer, Helen—Penetration of arsenic into cerebrospinal fluids—Treatment of
protozoal infections of central nervous system..... 1003

Dysentery:

Bacillary—

Haiti..... 171

Samoa..... 1225

Czechoslovakia..... 170, 323, 576, 1046, 1223

Esthonia..... 711

Finland..... 764

Latvia..... 1331

Poland..... 127, 224, 276, 373, 1167, 1505

Russia—Lettonia..... 374

Yugoslavia..... 325, 1111

Province of Voivodina..... 325

E.

Ecuador:

Diseases declared quarantinable..... 85

Guamote—Plague (human)..... 1432

Guayaquil—

Consulting health board established..... 1046

Plague (human)..... 85, 325, 651, 918, 1109, 1433

Plague (rodent)..... 85, 170, 325, 651, 764, 918, 1109, 1433

Health requirements for persons entering the country..... 764

Sabanilla—Plague (human)..... 918

Eggs—Liquid—Source of boric acid in cake—England..... 512

Egypt—Plague (human)..... 987

El Salvador—Quarantine restrictions established against, by Honduras—Small-
pox..... 988England—London—Plague (rodent)—Infected rats and cats found on vessel
arriving from South America..... 372

England and Wales:

Birth and death rates—1922, and first quarter 1923..... 1407

Vital statistics—1921 and 1922..... 683

Epidemic diseases:

Colombia—Bucaramanga..... 650, 917

Finland—Year, 1922..... 764

Esthonia, Republic of:

(See also Russia—Esthonia.)

Communicable diseases..... 576, 711, 918, 1223, 1502

Dysentery..... 711

Syphilis..... 711

Evans, Alice C.—Abortion in a cow produced by inoculation with bacterium
melitensis..... 825Examinations—Entrance into regular corps of the United States Public Health
Service—Time and places..... 202, 252, 301, 349

F.

Finland:

Communicable diseases..... 764

Dysentery..... 764

Epidemic diseases—Year, 1922..... 764

Lethargic encephalitis..... 764

Fish—Poisoning on the U. S. S. *Florida* during 1922—Vicinity of Virgin Islands. 1405Floc—Relation of hydrogen ion concentration to formation of, in alum solu-
tions—Theriault and Clark..... 181

Florida:

(See also Summaries—Disease cases reported monthly by States.)	Page.
Current State morbidity summaries.....	19,
68, 107, 149, 205, 256, 304, 353, 409, 463, 519, 630, 691, 744, 791, 843, 896,	
969, 1027, 1091, 1147, 1204, 1275, 1359, 1412, 1484.	
Summary of diseases—	
October, November, December, 1922.....	568
January, February, March, 1923.....	1325
Fly larvæ—Toxin-producing anaerobe isolated from—Bengtson.....	340
Food handlers—Health certificates required—Texas court decision.....	404
France—Paris—Plague (human).....	1502
Francis, Edward—IX. Tularemia in the Washington (D. C.) market.....	1391
Fumigation—Of vessels from plague-infected ports—Grubbs.....	59

G.

Georgia:

Current State morbidity summaries.....	20,
69, 107, 149, 205, 256, 304, 353, 409, 463, 519, 630, 691, 744, 791, 843, 896,	
969, 1027, 1091, 1147, 1204, 1276, 1359, 1412, 1484.	
Savannah—Extract from New York Health News Service on politics and public health.....	965
German seaports—Health measures employed at.....	1139
Germany—Berlin—Tropical malaria.....	1046
Goiter—Prevention of—Kimball.....	877
Great Britain—Scotland—Glasgow—Undefined disease outbreak—Probably lethargic encephalitis.....	987
Greece:	
Athens—Influenza mortality.....	711
Cerebrospinal meningitis.....	223
Island of Corfu—Typhus fever.....	576
Kalamata—Lethargic encephalitis.....	811
Piræus—Typhus fever.....	576
Smallpox.....	223
Typhus fever.....	223
Grubbs, S. B.—Fumigation of vessels from plague-infected ports.....	59
Guadeloupe (West Indies):	
Alastrim—Vaccination against.....	651
Basse Terre—Alastrim or kaffir pox.....	224
Quarantine imposed against, at Trinidad, removed.....	712
Smallpox (reported as alastrim).....	811
Quarantine against Dominica for smallpox (reported as alastrim).....	1223
Guatemala—Quarantine restrictions established against, by Honduras—Smallpox.....	988

H.

Haiti—Dysentery (bacillary).....	171
Hasseltine, H. E.—Effect of vaccinia upon leprosy.....	1
Hawaii:	
(See also Summaries—Disease cases reported monthly by States.)	
Hamakua—Pohakea—Plague—Infected rat found.....	1166
Honokaa—Plague (rodent)—Infected rats found.....	576, 863
Summary of diseases—	
October, November, December, 1922.....	568
January, February, March, 1923.....	1325
Health:	
Consulting board established at Guayaquil, Ecuador.....	1046
Extent of rural service in the United States—Lumsden.....	885
Measures employed at German seaports.....	1139
Progress in conservation during the past fifty years—Kober.....	725
Requirements for persons entering Ecuador.....	764
Health authorities—Conference—Washington, D. C., May 16 and 17, 1923—Program.....	1021
Health Board—Consulting—Established at Guayaquil, Ecuador.....	1046
Health Committees of the League of Nations—Notes from.....	616
Health films—List of, issued by the National Health Council.....	404
Health officers—Whole time, county—Directory, 1923.....	1081

	Honduras:	Page.
	Quarantine against El Salvador and Guatemala—Smallpox.....	988
	Smallpox.....	918
	Hungary—Budapest and country districts—Typhus fever.....	1502
	Hydrogen ion concentrations.—Relation to formation of floc in alum solutions— Theriault and Clark.....	181
	I.	
	Idaho:	
	(See also Summaries—Disease cases reported monthly by States.)	
	Summary of diseases—	
	October, November, December, 1922.....	568
	January, February, March, 1923.....	1325
	Illinois,	
	(See also Summaries—Disease cases reported monthly by States.)	
	Chicago—Anthrax.....	1487
	Current State morbidity summaries.....	20,
	69, 107, 149, 205, 256, 353, 356, 409, 463, 519, 630, 691, 744, 791, 843, 896, 969,	
	1027, 1091, 1147, 1205, 1276, 1359, 1412, 1484.	
	Summary of diseases—	
	October, November, December, 1922.....	568
	January, February, March, 1923.....	1325
	India:	
	Calcutta—	
	Cholera.....	125, 1224
	Smallpox.....	125
	Madras Presidency—Anthrax.....	171
	Indiana:	
	(See also Summaries—Disease cases reported monthly by States.)	
	Current State morbidity summaries.....	20,
	69, 107, 149, 205, 256, 304, 353, 409, 463, 519, 630, 691, 744, 791, 843, 896, 966,	
	1027, 1091, 1147, 1276, 1279, 1359, 1412, 1484.	
	Summary of diseases—	
	October, November, December, 1922.....	569
	January, February, March, 1923.....	1326
	Industrial insurance companies—Mortality summaries.....	144
	Infantile paralysis. (See Poliomyelitis.)	
	Infectious diseases:	
	(See also Communicable diseases; Epidemic diseases; Notifiable diseases.)	
	Chile—Antofagasta—Report of diseases treated at hospital.....	710
	Influenza:	
	(See also Summaries—Disease cases reported monthly by States.)	
	And pneumonia—Deaths in large cities.....	100, 201, 346
	British West Indies—Trinidad.....	1505
	City reports for week ended—	
	December 16, 1922.....	24
	December 23, 1922.....	73
	December 30, 1922.....	111
	January 6, 1923.....	155
	January 13, 1923.....	209
	January 20, 1923.....	261
	January 27, 1923.....	308
	February 3, 1923.....	357
	February 10, 1923.....	413
	February 17, 1923.....	467
	February 24, 1923.....	525
	March 3, 1923.....	634
	March 10, 1923.....	695
	March 17, 1923.....	748
	March 24, 1923.....	795
	March 31, 1923.....	848
	April 7, 1923.....	902
	April 14, 1923.....	973
	April 21, 1923.....	1031
	April 28, 1923.....	1095
	May 5, 1923.....	1152
	May 12, 1923.....	1209

Influenza—Continued.

City reports for week ended—Continued.	Page.
May 19, 1923.....	1280
May 26, 1923.....	1363
June 2, 1923.....	1418
June 9, 1923.....	1488
Greece—Athens—Mortality.....	711
Mexico—Tabasco—Cunduacan.....	863
Prevalence in United States.....	63, 141, 199, 250, 345, 403, 459, 515, 627, 686
South Carolina.....	109
State morbidity reports—	
October, November, December, 1922.....	541
January, February, March, 1923.....	1295
Union of South Africa—Beira.....	577
Iowa:	
(See also Summaries—Disease cases reported monthly by States.)	
Current State morbidity summaries.....	20,
69, 107, 149, 205, 256, 304, 353, 409, 463, 519, 630, 691, 744, 791, 843, 896,	
969, 1027, 1091, 1147, 1205, 1276, 1359, 1412, 1484.	
Summary of diseases—	
October, November, December, 1922.....	569
January, February, March, 1923.....	1326
Iraq (Mesopotamia):	
(See also Mesopotamia.)	
Suimaichah—Plague (human).....	988
Ireland—Belmullet—Typhus fever.....	171
Italy:	
Catania—Lethargic encephalitis.....	765
Certain localities declared plague infected—Royal Swedish Board of Trade.	483
J.	
Jamaica:	
Alastrim.....	85, 171, 275, 372, 482, 651, 712
Kingston—	
Lethargic encephalitis.....	651
Smallpox (reported as alastrim).....	1433
Kingston and vicinity—Typhoid fever.....	86,
171, 275, 372, 483, 712, 765, 919, 1047, 1224, 1433	
Leprosy.....	1224
Quarantine regulations revised, 1923.....	482
St. Thomas Parish—Alastrim.....	85
Smallpox (reported as alastrim).....	765, 919, 1047, 1224
Japan:	
Osaka—Plague (human).....	171
Taiwan Island—Cerebrospinal meningitis.....	919, 1047
Java:	
Klaten—Plague (human).....	125
Plague (human).....	125, 576

K.

Kaffir pox—Guadeloupe (West Indies)—Basse Terre.....	224
Kansas:	
(See also Summaries—Disease cases reported monthly by States.)	
Current State morbidity summaries.....	20,
69, 107, 149, 205, 256, 304, 353, 409, 463, 519, 630, 691, 744, 791, 843,	
896, 969, 1027, 1091, 1147, 1276, 1412, 1415, 1484.	
Summary of diseases—	
October, November, December, 1922.....	569
January, February, March, 1923.....	1326
Kentucky—Current State morbidity summaries.....	22, 71, 110, 152, 259, 307
Kidder, C. W.—Schick tests and immunization against diphtheria in Vermont..	663
Kimball, O. P.—Prevention of simple goiter.....	877
King, M. R.—Incidence of venereal diseases among American seamen in the Orient.....	1477
Kober, George Martin—Progress in health conservation during the past 50 years.....	725
Komp, W. H. W.—Mosquito identification in malaria control work.....	1061

Page.	L.	Page.
1280		
1363		
1418		
1488		
711		
863		
7, 686		
109		
541		
1295		
577		
20,		
896,		
569		
1326		
988		
171		
765		
483		
712		
651		
1433		
86,		
1433		
1224		
482		
85		
1224		
171		
1047		
125		
576		
224		
20,		
843,		
569		
326		
307		
663		
877		
477		
725		
061		
	Lake, G. C.—Parasiticide values of arsphenamine and neocarsphenamine in "arsenic fast" strains of trypanosomes.....	1347
	Latvia:	
	Communicable diseases.....	651, 652, 1109, 1331
	Dysentery.....	1331
	Leprosy.....	1331
	Libau—Typhus fever.....	1224
	Rabies in man.....	1331
	Laws—State tuberculosis—Index to—Tobey.....	1191
	League of Nations:	
	International cooperative work of the health section.....	784
	Notes from health committee of.....	616
	Leprosy:	
	Brazil—	
	Manaos.....	36
	Para.....	322
	California—	
	Los Angeles.....	850, 1419
	Sacramento.....	636
	San Francisco.....	309, 415, 1209, 1419, 1489
	City reports for week ended—	
	December 16, 1922.....	24
	December 30, 1922.....	112
	January 6, 1923.....	156
	January 27, 1923.....	309
	February 3, 1923.....	359
	February 10, 1923.....	415
	March 3, 1923.....	636
	March 31, 1923.....	850
	April 7, 1923.....	904
	April 14, 1923.....	974
	April 21, 1923.....	1032
	May 12, 1923.....	1209
	May 19, 1923.....	1281
	June 2, 1923.....	1419
	June 9, 1923.....	1489
	Effect of vaccinia on—Hasseltine.....	1
	Jamaica.....	1224
	Latvia.....	1331
	Louisiana—New Orleans.....	359, 904
	Ordinance for suppression of, adopted—New Guinea.....	1377
	Russia—Lettonia.....	127, 374
	State morbidity summaries—	
	October, November, December, 1922.....	545
	January, February, March, 1923.....	1306
	Syria—Damascus.....	1377
	Texas—	
	Fort Worth.....	1281
	Galveston.....	156
	Lethargic encephalitis:	
	Bulgaria—Sofia.....	650, 763
	California—San Francisco.....	1209
	Canada—	
	British Columbia—Vancouver.....	574
	Dalhousie Junction.....	862
	Manitoba—Winnipeg.....	574, 862, 1222, 1330
	Saskatchewan—Regina.....	810
	Vancouver.....	987
	City reports for week ended—	
	December 16, 1922.....	25
	December 23, 1922.....	74
	January 6, 1923.....	156
	January 13, 1923.....	210
	January 20, 1923.....	262
	January 27, 1923.....	309

Lethargic encephalitis—Continued.

City reports for week ended—Continued.	Page.
February 3, 1923.....	359
February 10, 1923.....	415
February 17, 1923.....	469
February 24, 1923.....	527
March 3, 1923.....	636
March 10, 1923.....	697
March 17, 1923.....	750
March 24, 1923.....	797
March 31, 1923.....	850
April 7, 1923.....	904
April 14, 1923.....	974
April 21, 1923.....	1032
April 28, 1923.....	1096
May 12, 1923.....	1209
May 19, 1923.....	1281
May 26, 1923.....	1363
June 2, 1923.....	1419
June 9, 1923.....	1489
Finland.....	764
Great Britain—Scotland—Glasgow—Probable outbreak.....	987
Greece—Kalamata.....	811
Italy—Catania.....	765
Jamaica—Kingston.....	651
Nebraska—Omaha.....	25
New Jersey—Jersey City.....	1281
Portugal—Lisbon.....	864, 1048
Syria—Beirut.....	1167-1505
Union of South Africa—Beira.....	577
Lithuania—Vital statistics—January-June, 1922.....	1109
Longevity—Body weight and.....	1271
Louisiana:	
(See also Summaries—Disease cases reported monthly by States.)	
Baton Rouge—Dengue.....	357
Current State morbidity summaries.....	20,
69, 107, 149, 205, 256, 304, 353, 409, 463, 519, 630, 691, 744, 791, 843, 897,	
969, 1027, 1091, 1147, 1205, 1276, 1359, 1412, 1484.	
New Orleans—	
Dengue.....	111, 209, 260, 308
Leprosy.....	359
Summary of diseases—	
October, November, December, 1922.....	569
January, February, March, 1923.....	1326
Lowry, Edith B.—Health scoring of school children.....	285
Lumsden, L. L.—Extent of rural health service in the United States.....	885

Mc.

McClosky, William T.—Studies on the bio-assay of pituitary extracts.....	493
--	-----

M.

Madagascar—Plague (human).....	125, 372, 429, 652, 919, 988, 1110, 1224
Maine:	
(See also Summaries—Disease cases reported monthly by States.)	
Current State morbidity summaries.....	20,
69, 107, 149, 205, 257, 304, 353, 409, 463, 519, 630, 691, 744, 791, 843, 896,	
1027, 1091, 1147, 1205, 1276, 1359, 1412, 1484.	
Standish—Smallpox.....	847
Summary of diseases—	
October, November, December, 1922.....	569
January, February, March, 1923.....	1326

Malaria:

(See also Summaries—Disease cases reported monthly by States.)

Page.

Brazil—Manaos.....	36
City reports for week ended—	
December 16, 1922.....	25
December 23, 1922.....	74
December 30, 1922.....	112
January 6, 1923.....	156
January 13, 1923.....	210
January 20, 1923.....	262
January 27, 1923.....	310
February 3, 1923.....	359
February 10, 1923.....	415
February 17, 1923.....	468
February 24, 1923.....	527
March 3, 1923.....	636
March 10, 1923.....	697
March 17, 1923.....	750
March 24, 1923.....	797
March 31, 1923.....	850
April 7, 1923.....	904
April 14, 1923.....	974
April 21, 1923.....	1032
April 28, 1923.....	1096
May 5, 1923.....	1153
May 12, 1923.....	1210
May 19, 1923.....	1281
May 26, 1923.....	1363
June 2, 1923.....	1419
June 9, 1923.....	1489
Czechoslovakia.....	170, 323, 1223
Distribution in the United States—Indicated by mortality reports—	
Maxcy.....	1125
Mexico—Progreso and vicinity.....	712
Pernicious—Colombia—Bucaramanga.....	917, 1045
Poland.....	276
Problem of southeast Missouri—Maxcy.....	233
State morbidity summaries—	
October, November, December, 1922.....	546
January, February, March, 1923.....	1306
Tropical—Germany—Berlin.....	1046
Malta—Trachoma.....	712
Martinique (West Indies—Smallpox (reported as alastrim).....	811, 1224
Maryland:	
(See also Summaries—Disease cases reported monthly by States.)	
Current State morbidity summaries.....	20,
69, 108, 150, 206, 257, 304, 353, 409, 463, 520, 630, 691, 744, 791, 843,	
896, 969, 1028, 1091, 1147, 1205, 1276, 1359, 1412, 1484.	
Summary of diseases—	
October, November, December, 1922.....	569
January, February, March, 1923.....	1326
Massachusetts:	
Boston—Rabies in man.....	115, 159
Current State morbidity summaries.....	20,
69, 108, 150, 206, 257, 304, 354, 410, 463, 520, 631, 692, 744, 792, 844,	
897, 969, 1028, 1092, 1148, 1205, 1276, 1359, 1412, 1485.	
Summary of diseases—	
October, November, December, 1922.....	569
January, February, March, 1923.....	1326
Webster—Anthrax.....	1362
Mauritius—Plague (human).....	1047
Maxcy, Kenneth F.:	
Distribution of malaria in the United States as indicated by mortality	
reports.....	1125
Malaria problem of southeast Missouri.....	233

Measles:

(See also Summaries—Disease cases reported monthly by States.)

City reports for week ended—	Page.
December 16, 1922.....	30
December 23, 1922.....	78
December 30, 1922.....	117
January 6, 1923.....	162
January 13, 1923.....	215
January 20, 1923.....	268
January 27, 1923.....	314
February 3, 1923.....	364
February 10, 1923.....	420
February 17, 1923.....	474
February 24, 1923.....	531
March 3, 1923.....	642
March 10, 1923.....	702
March 17, 1923.....	755
March 24, 1923.....	802
March 31, 1923.....	855
April 7, 1923.....	908
April 14, 1923.....	979
April 21, 1923.....	1037
April 28, 1923.....	1100
May 5, 1923.....	1158
May 12, 1923.....	1215
May 19, 1923.....	1285
May 26, 1923.....	1368
June 2, 1923.....	1423
June 9, 1923.....	1494
Siberia—Vladivostok.....	765
Meningitis:	
(See also Cerebrospinal meningitis.)	
Acute—Mexico—Frontera.....	988
Mesopotamia—Bagdad:	
Plague (human).....	126
Smallpox.....	126
Metropolitan Life Insurance Co.:	
Death rates in a group of insured persons.....	65, 145, 347, 786, 1141, 1201, 1480
Death rates in a group of insured persons and mortality by age groups....	1141
Mexico:	
Frontera—Cerebrospinal meningitis.....	988
Progreso and vicinity—Malaria.....	712
Tabasco—Cunduacan—Influenza.....	863
Tampico—Plague (rodent).....	712
Tuxtepec—Yellow fever.....	811
Vera Cruz—Smallpox.....	712
Michigan:	
(See also Summaries—Disease cases reported monthly by States.)	
Court decision—Compensation for typhoid fever under workmen's compensation act.....	1272
Current State morbidity summaries.....	21,
70, 108, 150, 206, 257, 305, 354, 410, 464, 520, 631, 692, 745, 792, 844, 897, 969, 1028, 1092, 1148, 1205, 1277, 1360, 1413, 1485.	
Summary of diseases—	
October, November, December, 1922.....	570
January, February, March, 1923.....	1327
Milk—Regulation requiring pasteurization of—Supreme Court decision—New York.....	98
Minnesota:	
(See also Summaries—Disease cases reported monthly by States.)	
Current State morbidity summaries.....	21,
70, 108, 150, 206, 257, 305, 354, 410, 464, 520, 631, 692, 745, 792, 844, 897, 970, 1028, 1092, 1148, 1277, 1279, 1360, 1413, 1485.	
Summary of diseases—	
October, November, December, 1922.....	570
January, February, March, 1923.....	1327
Trachoma problem in—Clark.....	383
Typhoid fever—Correction.....	202

Mississippi:

(See also Summaries—Disease cases reported monthly by States.) Page.

Current State morbidity summaries..... 21,
 70, 109, 150, 206, 257, 305, 354, 410, 464, 520, 631, 692, 745, 792, 844,
 897, 970, 1028, 1092, 1148, 1277, 1279, 1360, 1413, 1485.

Summary of diseases—

October, November, December, 1922..... 570

January, February, March, 1923..... 1327

Missouri:

(See also Summaries—Disease cases reported monthly by States.)

Current State morbidity summaries..... 21,
 108, 150, 257, 305, 354, 410, 464, 520, 631, 692, 745, 792, 844, 897, 970,
 1028, 1092, 1148, 1277, 1279, 1360, 1413, 1485.

Malaria problem in the southeast—Maxcy..... 233

Montana:

(See also Summaries—Disease cases reported monthly by States.)

Current State morbidity summaries..... 21,
 70, 108, 150, 206, 257, 305, 354, 410, 464, 520, 631, 692, 745, 792, 844,
 897, 970, 1028, 1092, 1148, 1205, 1277, 1360, 1413, 1485.

Eight years of epidemic poliomyelitis in—Sippy..... 135

Helena—Rocky Mountain spotted or tick fever..... 977, 1156

Summary of diseases—

October, November, December, 1922..... 570

January, February, March, 1923..... 1327

Mortality:

Bolivia—La Paz—1922..... 710

Brazil—Pernambuco—Recife—1911-1922..... 1431

Chile—Concepcion—

February, 1923..... 916

March, 1923..... 1222

April, 1923..... 1330

Influenza—Greece—Athens..... 711

Peru—

Calloa—1918-1922..... 1503

Lima, 1918-1922..... 1503

Provisional figures, 1922—Bureau of the Census compilation..... 15

Summary for 62 large cities..... 104

Summary—Industrial insurance companies..... 144

Typhoid fever, tuberculosis, pneumonia—In 43 large cities..... 142

Mortality and birth rates—Bureau of the Census compilation:

Provisional figures, first nine months, 1922..... 513

Provisional figures, year 1922..... 1353

Mosquitoes:

Identification in malaria control work—Komp..... 1061

Use of creosote oil as a repellent—Coogle..... 437

N.

National Health Council—List of health films issued by..... 404

Nebraska:

(See also Summaries—Disease cases reported monthly by States.)

Current State morbidity summaries..... 21,
 70, 108, 150, 206, 257, 305, 354, 410, 464, 520, 631, 692, 745, 792, 844,
 897, 970, 1028, 1092, 1148, 1206, 1277, 1360, 1413, 1485.

Omaha—Lethargic encephalitis..... 25

Summary of diseases—

October, November, December, 1922..... 570

January, February, March, 1923..... 1327

Neosarsphenamine—Parasiticide values of, and arsphenamine in "arsenic fast"⁷

strains of trypanosomes—Lake and Probey..... 1347

Netherlands—Rotterdam—Typhus fever..... 1331

New Guinea—Ordinance for suppression of leprosy adopted..... 1377

New Jersey:

(See also Summaries—Disease cases reported monthly by States.)

Court decision—Sewer connections made by municipality at owner's ex-
 pense..... 1085

New Jersey—Continued.	Page.
Current State morbidity summaries.....	21,
70, 108, 150, 206, 257, 305, 354, 410, 464, 520, 631, 692, 745, 792, 844,	
897, 970, 1028, 1092, 1148, 1205, 1277, 1360, 1413, 1485.	
Jersey City—Lethargic encephalitis.....	1281
Summary of diseases—	
October, November, December, 1922.....	570
January, February, March, 1923.....	1327
New Mexico:	
(See also Summaries—Disease cases reported monthly by States.)	
Current State morbidity summaries.....	21,
70, 150, 206, 257, 305, 354, 410, 464, 631, 692, 745, 792, 844, 897, 970,	
1028, 1092, 1148, 1206, 1277, 1360, 1413, 1485.	
Summary of diseases—October, November, December, 1922.....	571
New York:	
(See also Summaries—Disease cases reported monthly by States.)	
Current State morbidity summaries.....	21,
70, 109, 150, 206, 258, 305, 354, 410, 464, 520, 631, 692, 745, 793, 844, 898,	
970, 1029, 1092, 1148, 1206, 1277, 1360, 1413, 1485.	
Extract from Health News Service—Politics and public health.....	965
Summary of diseases—	
October, November, December, 1922.....	571
January, February, March, 1923.....	1327
Water pollution results from lack of cooperation between water board of	
health and health officer.....	838
Newfoundland—St. John's—Scarlet fever.....	919
North Carolina:	
(See also Summaries—Disease cases reported monthly by States.)	
Current State morbidity summaries.....	21,
70, 109, 151, 207, 258, 305, 355, 464, 521, 632, 692, 745, 793, 844, 898, 970,	
1029, 1093, 1149, 1206, 1277, 1360, 1413, 1486.	
Summary of diseases—	
October, November, December, 1922.....	571
January, February, March, 1923.....	1328
North Dakota:	
(See also Summaries—Disease cases reported monthly by States.)	
Current State morbidity summaries.....	22,
71, 110, 152, 208, 259, 356, 411, 522, 633, 693, 746, 794, 845, 899, 971, 1030	
1093, 1149, 1207, 1279, 1362, 1415, 1487.	
Summary of diseases—	
October, November, December, 1922.....	571
January, February, March, 1923.....	1328
Norway—Trondhjem—School dental clinic at.....	964
Nutrition:	
Comparison of different indices of—Clark, Sydenstricker and Collins.....	1239
Heights and weights of children as an index of—Clark, Sydenstricker,	
Collins.....	39
O.	
Occupational diseases and disabilities—State morbidity reports:	
October, November, December, 1922.....	549
January, February, March, 1923.....	1308
Ohio:	
(See also Summaries—Disease cases reported monthly by States.)	
Court decision—Quarantine for venereal diseases upheld.....	1273
Summary of diseases—	
October, November, December, 1922.....	571
January, February, March, 1923.....	1328
Oklahoma:	
(See also Summaries—Disease cases reported monthly by States.)	
Summary of diseases—	
October, November, December, 1922.....	571
January, February, March, 1923.....	1328
Ordinances—Health certificates required of food handlers—Texas court	
decision.....	404

Oregon:

(See also Summaries—Disease cases reported monthly by States.)

Current State morbidity summaries.....	Page. 21,
70, 109, 151, 207, 258, 305, 355, 410, 465, 521, 632, 693, 745, 793, 845, 898, 970, 1029, 1093, 1149, 1206, 1277, 1360, 1414, 1486	

Summary of diseases—

October, November, December, 1922.....	571
January, February, March, 1923.....	1328

Oxidation-reduction:

1. Introduction—Clark.....	443
2. Relations between reducing potentials and pH—Clark and Cohen.....	666
3. Electrode potentials of a new indophenol—Clark and Cohen.....	933

P.

Panama Canal:

Canal Zone—Colon—Panama—Prohibited importations on account of foot-and-mouth disease.....	812
Communicable diseases.....	172, 275, 483, 713, 988, 1331
Quarantine against ports in Chiriqui Province, removed.....	173
Quarantine against north-coast Colombian ports.....	1225
Vaccination of persons arriving from Valparaiso, Chile.....	373
Paratyphoid fever—Czechoslovakia.....	323

Parker, R. R.—Rocky Mountain spotted fever, infectivity of fasting and
recently fed ticks..... 333

Pasteur—An appreciation of his work and methods—Clark..... 81

Pellagra:

(See also Summaries—Disease cases reported monthly by States.)

City reports for week ended—

December 16, 1922.....	25
December 23, 1922.....	74
December 30, 1922.....	112
January 6, 1923.....	157
January 13, 1923.....	211
January 20, 1923.....	262
January 27, 1923.....	310
February 3, 1923.....	360
February 10, 1923.....	416
February 17, 1923.....	469
February 24, 1923.....	527
March 3, 1923.....	636
March 10, 1923.....	697
March 17, 1923.....	750
March 24, 1923.....	797
March 31, 1923.....	850
April 7, 1923.....	904
April 14, 1923.....	975
April 21, 1923.....	1032
April 28, 1923.....	1096
May 5, 1923.....	1153
May 12, 1923.....	1210
May 19, 1923.....	1281
May 26, 1923.....	1364
June 2, 1923.....	1419
June 9, 1923.....	1489

State morbidity reports—

October, November, December, 1922.....	549
January, February, March, 1923.....	1309

Pennsylvania:

(See also Summaries—Disease cases reported monthly by States.)

Philadelphia—Anthrax.....	23, 72, 111
---------------------------	-------------

Summary of diseases—

October, November, December, 1922.....	572
January, February, March, 1923.....	1328

Peru:

Callao—Mortality, 1918-1922.....	1503
Lima—Mortality, 1918-1922.....	1503
Plague (human).....	126, 276, 652, 713, 919, 1110, 1225, 1433
Smallpox.....	276

	Page.
Pituitary extracts—An infundibular powder as a standard in evaluating— Smith and McCloskey.....	493
Plague (human):	
Argentina—Rosario.....	809
Australia declared free from.....	987
Azores—	
Castelo Branco—Island of Fayal.....	223, 809
St. Michaels Island.....	169, 650, 809, 1376
Brazil—Bahia.....	1431
Canary Islands—January-March, 1923.....	916
Celebes (Malay Archipelago)—Macassar.....	810
Ecuador—	
Guamote.....	1432
Guayaquil.....	85, 325, 651, 1109, 1433
Sabanilla.....	918
Egypt.....	987
Foreign reports—	
Cumulative table.	88, 132, 176, 227, 279, 327, 376, 431, 486, 579, 656, 716, 768, 817, 867, 923, 992, 1050, 1113, 1170, 1228, 1334, 1380, 1437, 1507
Weekly table.....	37, 87, 129, 174, 225, 277, 325, 374, 429, 483, 577, 653, 714, 766, 814, 865, 920, 990, 1048, 1111, 1168, 1226, 1332, 1378, 1434, 1505
France—Paris.....	1502
Iraq (Mesopotamia)—Suimaichah.....	988
Japan—Osaka.....	171
Java.....	125, 576
Klaten.....	125
Madagascar.....	125, 372, 429, 652, 919, 988, 1110, 1224
Mauritius.....	1047
Mesopotamia—Bagdad.....	126
On vessel—Steamship <i>Helcion</i> arriving at Thursday Island quarantine.	372
Peru.....	126, 276, 652, 713, 919, 1110, 1225, 1433
Portugal—Lisbon.....	86
Portuguese West Africa—Loanda.....	86
Russia—Kurghez Republic.....	813
Spain—	
Barcelona.....	173
Malaga.....	576, 1433
Tunis—	
Ben-Gardane.....	1110
Taguelmit—Pneumonic.....	1433
Turkey—Constantinople.....	652
Union of South Africa—Transvaal—	
Klipfontein.....	1377
Molteno district.....	653
Plague (rodent):	
Australia declared free from.....	987
California—Contra Costa County—Alamo—Infected ground squirrels found.....	1416
Canary Islands—February, March, 1923.....	916
Ecuador—Guayaquil.....	85, 170, 324, 651, 764, 918, 1109, 1433
England—London—Infected rats and cats found on vessel arriving from South America.....	372
Fumigation of vessels from infected ports—Grubbs.....	59
Hawaii—	
Hamakua—Pohakea—Infected rat found.....	1166
Honokaa—Rats infected found.....	576, 863
Infected rats and cats—On vessel arriving at London, England, from South America.....	372
Mexico—Tampico.....	712
Union of South Africa—Transvaal—Molteno district.....	653
Pneumonia (all forms):	
And influenza—Deaths in large cities.....	100
City reports for week ended—	
December 16, 1922.....	25
December 23, 1922.....	74
December 30, 1922.....	113
January 6, 1923.....	157

Pneumonia (all forms)—Continued.

City reports for week ended—Continued.

Page.

January 13, 1923.....	211
January 20, 1923.....	262
January 27, 1923.....	310
February 3, 1923.....	360
February 10, 1923.....	416
February 17, 1923.....	470
February 24, 1923.....	527
March 3, 1923.....	636
March 10, 1923.....	697
March 17, 1923.....	750
March 24, 1923.....	798
March 31, 1923.....	850
April 7, 1923.....	904
April 14, 1923.....	975
April 21, 1923.....	1032
April 28, 1923.....	1096
May 5, 1923.....	1154
May 12, 1923.....	1210
May 19, 1923.....	1281
May 26, 1923.....	1364
June 2, 1923.....	1419
June 9, 1923.....	1489
Tuberculosis and typhoid fever—Mortality from, in 43 large cities.....	142

Poland:

Communicable diseases.....	126, 224, 276, 373, 812, 864, 989, 1166,	1504
Dysentery.....	127, 224, 276, 373, 1167,	1505
Malaria.....		276
Warsaw—Trichinosis.....		127

Poliomyelitis:

(See also Summaries—Disease cases reported monthly by States.)

City reports for week ended—

December 16, 1922.....	27
December 23, 1922.....	76
December 30, 1922.....	115
January 6, 1923.....	159
January 13, 1923.....	212
January 20, 1923.....	265
January 27, 1923.....	312
February 3, 1923.....	362
February 10, 1923.....	418
February 17, 1923.....	472
February 24, 1923.....	530
March 3, 1923.....	639
March 10, 1923.....	700
March 17, 1923.....	752
March 24, 1923.....	800
March 31, 1923.....	852
April 7, 1923.....	906
April 14, 1923.....	977
April 21, 1923.....	1034
April 28, 1923.....	1098
May 5, 1923.....	1155
May 12, 1923.....	1212
May 19, 1923.....	1283
May 26, 1923.....	1366
June 2, 1923.....	1421
June 9, 1923.....	1491

State morbidity reports—

October, November, December, 1922.....	550
January, February, March, 1923.....	1310

Politics—And public health—Extract from New York Health News Service... 965

Population—Changes in United States, 1910-1920—Census Monograph No. 1.. 958

Portugal—Lisbon:

Lethargic encephalitis.....	864, 1048
Plague (human).....	86

	Page.
Portuguese West Africa—Loanda—Plague (human).....	86
Proby, T. F.—Parasiticial values of arsphenamine and neoarsphenamine in "arsenic fast" strains of trypanosomes.....	1347
Public health—And politics—Extract from New York Health News Service..	965
Publications—List of—Issued by United States Public Health Service.....	1085

Q.

Quarantine:

Against El Salvador and Guatemala by Honduras.....	988
Against Martinique by Trinidad, West Indies—Occurrence of alastrim....	1110
Circular imposing, against ports in Chiriqui Province removed.....	173
Declared at Cuban ports against Venezuela.....	1377
Diseases declared quarantinable—Ecuador.....	85
Disinfection measures ordered enforced at Cuban ports.....	223
Imposed against Dominica by Guadeloupe, West Indies.....	1223
Imposed against north coast Colombia ports by Panama Canal.....	1225
Measures against Gulf ports in United States suspended.....	85
Quarantinable diseases—Ecuador.....	85
Quarantine regulations—Jamaica—Revised, 1923.....	482

R.

Rabies in animals—City reports for week ended—

December 16, 1922.....	27
December 23, 1922.....	76
December 30, 1922.....	115
January 6, 1923.....	159
January 13, 1923.....	213
January 20, 1923.....	265
January 27, 1923.....	312
February 3, 1923.....	362
February 10, 1923.....	418
February 17, 1923.....	472
February 24, 1923.....	530
March 3, 1923.....	639
March 10, 1923.....	700
March 17, 1923.....	753
March 24, 1923.....	800
March 31, 1923.....	853
April 7, 1923.....	907
April 14, 1923.....	977
April 21, 1923.....	1035
April 28, 1923.....	1098
May 5, 1923.....	1156
May 12, 1923.....	1212
May 19, 1923.....	1283
May 26, 1923.....	1366
June 2, 1923.....	1421
June 9, 1923.....	1491

Rabies in man:

Alabama—Tuscaloosa.....	1156
California—	
Los Angeles.....	639, 1283, 1366
San Bernardino.....	1421

City reports for week ended—

December 16, 1922.....	28
December 30, 1922.....	115
January 6, 1923.....	159
February 3, 1923.....	363
February 17, 1923.....	472
March 3, 1923.....	639
May 5, 1923.....	1156
May 12, 1923.....	1212
May 19, 1923.....	1283
May 26, 1923.....	1366
June 2, 1923.....	1421
Czechoslovakia.....	170, 323, 576, 1046, 1223
Latvia.....	1331

	Page.
Rabies in man—Continued.	
Massachusetts—Boston.....	115, 159
New York—New York.....	1212
Russia—Lettonia.....	374
Texas—Dallas.....	28
Rate—Plague-infected found—	
Ecuador—Guayaquil.....	85, 170, 325, 651, 764, 918
Hawaii—	
Hamakua—Pohakea.....	1166
Honokaa.....	576, 863
On vessel arriving at London, England, from South America.....	372
Reciprocal notification of disease cases:	
November, 1922.....	72
December, 1922.....	260
January, 1923.....	412
February, 1923.....	794
March, 1923.....	901
April, 1923.....	1208
May, 1923.....	1487
Registrars—Held to be county employees—Supreme Court decision—Arkansas.	1356
Relapsing fever—Russia.....	128
Rhode Island—Summary of diseases:	
October, November, December, 1922.....	572
January, February, March, 1923.....	1328
Rocky Mountain spotted or tick fever:	
City reports for week ended April 14, 1923.....	977
Infectivity of fasting and recently fed ticks—Spencer and Parker.....	333
Montana—Helena.....	977, 1156
State morbidity reports—January, February, March, 1923.....	1312
Rumania—Bucharest—Typhus fever.....	276
Russia:	
Cholera.....	127
Esthonia—	
(See also Esthonia, Republic of.)	
Communicable diseases.....	127, 576, 711, 918
Kirghiz Republic—Plague (human).....	813
Lettonia—	
Anthrax.....	127
Communicable diseases.....	127, 173, 374
Dysentery.....	374
Leprosy.....	374
Rabies in man.....	374
Moscow—Communicable diseases.....	813
Relapsing fever.....	128
Typhus fever.....	128
Ukraine—	
Communicable diseases.....	127
Tuberculosis.....	989
Venereal diseases.....	989
S.	
Samoa—Dysentery (bacillary).....	1225
Scarlet fever:	
(See also Summaries—Disease cases reported monthly by States.)	
City reports for week ended—	
Decemer 16, 1922.....	30
December 23, 1922.....	78
December 30, 1922.....	117
January 6, 1923.....	162
January 13, 1923.....	215
January 20, 1923.....	268
January 27, 1923.....	314
February 3, 1923.....	364
February 10, 1923.....	420
February 17, 1923.....	474
February 24, 1923.....	531
March 3, 1923.....	642
March 10, 1923.....	702

Scarlet fever—Continued.

	Page.
City reports for week ended—Continued.	
March 17, 1923.	755
March 24, 1923.	802
March 31, 1923.	855
April 7, 1923.	908
April 14, 1923.	979
April 21, 1923.	1037
April 28, 1923.	1100
May 5, 1923.	1158
May 12, 1923.	1215
May 19, 1923.	1285
May 26, 1923.	1368
June 2, 1923.	1423
June 9, 1923.	1499
Newfoundland—St. John's.	919
School—Experiments of dental clinic—Norway—Trondhjem.	969
School children:	
Free dental dispensary for destitute—Cienfuegos, Cuba.	142
Health scoring of—Clark and Lowry.	285
Rural—Physical care of—Clark.	1181
Sewer—Connections by municipality at owner's expense—Decision of Supreme Court—New Jersey.	1085
Siberia—Vladivostok—Measles.	765
Sippy, John J.—Eight years of epidemic poliomyelitis in Montana.	135
Smallpox:	
(See also Summaries—Disease cases reported monthly by States.)	
California—San Pedro—On S. S. <i>Ryder Hanify</i> arriving from Portland, Oreg.	1417
Chile—Valparaiso.	372, 650
City reports for week ended—	
December 16, 1922.	28
December 23, 1922.	77
December 30, 1922.	115
January 6, 1923.	160
January 13, 1923.	213
January 20, 1923.	266
January 27, 1923.	313
February 3, 1923.	363
February 10, 1923.	419
February 17, 1923.	473
February 24, 1923.	530
March 3, 1923.	640
March 10, 1923.	700
March 17, 1923.	753
March 24, 1923.	800
March 31, 1923.	853
April 7, 1923.	907
April 14, 1923.	978
April 21, 1923.	1035
April 28, 1923.	1099
May 5, 1923.	1156
May 12, 1923.	1213
May 19, 1923.	1284
May 26, 1923.	1366
June 2, 1923.	1422
June 9, 1923.	1492
Colombia—	
Buenaventura.	322
Santa Marta.	917
Dominica (West Indies)—Reported as alastrim.	811
Foreign reports—	
Cumulative table.	89,
132, 178, 228, 280, 328, 378, 433, 487, 581, 658, 718, 771, 819, 869, 926, 995,	
1053, 1117, 1173, 1231, 1383, 1440, 1511.	
Weekly table.	37,
87, 130, 174, 225, 277, 325, 375, 429, 484, 578, 654, 714, 766, 814, 865, 921,	
990, 1048, 1112, 1168, 1226, 1332, 1378, 1434, 1506.	

Smallpox—Continued.	Page.
Greece.....	223
Guadeloupe (West Indies)—	
Quarantine against Dominica on account of—Reported as alastrim....	1223
Reported as alastrim.....	811
Honduras.....	918
Increasing virulence of, in the United States.....	1406
India—Calcutta.....	125
Jamaica—	
Kingston—Reported as alastrim.....	1433
Reported as alastrim.....	765, 919, 1047, 1224
Maine—Standish.....	847
Martinique (West Indies)—Reported as smallpox.....	811, 1224
Mesopotamia—Bagdad.....	126
Mexico—Vera Cruz.....	712
On vessel—S. S. <i>Ryder Hanify</i> discharging cargo at Redondo Beach and	
San Pedro, Calif.....	1417
Peru.....	276
State morbidity reports—	
October, November, December, 1922.....	553
January, February, March, 1923.....	1312
Union of South Africa.....	128, 224, 813, 989, 1433
West Indies—	
Barbados—Reported as alastrim.....	1045
Dominica—Reported as alastrim.....	174
St. Lucia Island—Reported as alastrim.....	1048
Smith, F. C.—Tuberculosis—Predisposing causes.....	777
Smith, Maurice I.:—	
Penetration of arsenic into cerebrospinal fluids—Treatment of protozoal	
infections of central nervous system.....	1003
Studies on the bio-assay of pituitary extracts.....	493
South Carolina:	
(See also Summaries—Disease cases reported monthly by States.)	
Influenza.....	109
Summary of diseases—	
October, November, December, 1922.....	572
January, February, March, 1923.....	1328
South Dakota:	
(See also Summaries—Disease cases reported monthly by States.)	
Current State morbidity summaries.....	22,
70, 109, 151, 207, 258, 306, 355, 411, 465, 521, 632, 693, 746, 793, 845,	
878, 970, 1029, 1093, 1149, 1206, 1278, 1361, 1414, 1486.	
Summary of diseases—	
October, November, December, 1922.....	572
January, February, March, 1923.....	1329
Spain:	
Barcelona—Plague (human).....	173
Malaga—Plague (human).....	576, 1433
Spencer, R. R.—Rocky Mountain spotted fever; infectivity of fasting and re-	
cently fed ticks.....	333
St. Lucia (West Indies)—Smallpox (reported as alastrim).....	1048
Statistics—Vital:	
England and Wales—1921 and 1922.....	683
Lithuania—January–June, 1922.....	1109
Union of South Africa—Cape Town—June 30, 1921–22.....	713
Stiles, C. W.—Principles underlying the movement of <i>Bacillus coli</i> in ground	
water.....	1350
Sulfonphthalein indicators—New ones found for determination of hydrogen ion	
concentrations—Cohen.....	199
Summaries:	
Cases and case rates for certain communicable diseases—	
November, 1922.....	153
December, 1922.....	522
January, 1923.....	846
February, 1923.....	899
March, 1923.....	1150

Summaries—Continued.	Page.
Disease cases reported monthly by States.....	23,
72, 110, 152, 208, 259, 307, 356, 412, 466, 524, 633, 694, 747, 794, 846,	
899, 972, 1030, 1094, 1150, 1207, 1279, 1362, 1415, 1487.	
Mortality for 62 large cities.....	104
Mortality—Industrial insurance companies.....	144
Supreme Court decisions:	
(See also Court decisions.)	
Arkansas—Local registrars held to be county employees.....	1356
Michigan—Compensation for typhoid fever under workmen's compensation act.....	1272
New York—Regulation requiring pasteurization of milk.....	98
Sydenstricker, Edgar:	
Indices of nutrition.....	1239
Weights and heights as an index of nutrition.....	39
Syphilis—Esthonia.....	711
Syria:	
Beirut—	
Lethargic encephalitis.....	1167, 1505
Typhus fever.....	1167
Damascus—Leprosy.....	1377
Sweden—Localities in Italy declared plague infected.....	483
T.	
Tetanus:	
City reports for week ended—	
December 16, 1922.....	28
December 23, 1922.....	77
December 30, 1922.....	116
January 6, 1923.....	160
January 13, 1923.....	214
January 20, 1923.....	266
January 27, 1923.....	313
February 3, 1923.....	363
February 10, 1923.....	419
February 17, 1923.....	473
March 3, 1923.....	640
March 10, 1923.....	701
March 17, 1923.....	754
March 24, 1923.....	801
March 31, 1923.....	854
April 7, 1923.....	907
April 14, 1923.....	978
April 21, 1923.....	1036
April 28, 1923.....	1099
May 5, 1923.....	1157
May 12, 1923.....	1213
May 19, 1923.....	1284
May 26, 1923.....	1366
June 2, 1923.....	1422
June 9, 1923.....	1492
Texas:	
Court decision—Vaccination requirements to be met by pupils upheld....	1355
Current State morbidity summaries.....	22,
71, 109, 207, 208, 258, 306, 355, 411, 465, 521, 632, 693, 746, 793, 845,	
898, 971, 1029, 1093, 1149, 1206, 1278, 1361, 1414, 1486.	
Dallas—	
Court decisions—Ordinance requiring health certificates of food handlers upheld.....	404
Rabies in man.....	28
Fort Worth—Leprosy.....	1281
Galveston—Leprosy.....	156
Theriault, Emery J.—Relation of hydrogen ion concentrations to formation of floc in alum solutions.....	181
Thompson, J. W.—Penetration of arsenic into cerebrospinal fluid—Treatment of protozoal infections of central nervous system.....	1003
Tick—Eradication—Australia—New South Wales—Compulsory dipping of cattle.....	916
Tobey, James A.—Index to State tuberculosis laws.....	1191

	Page.
Trachoma:	
Malta.....	712
Problem in Minnesota—Clark.....	383
Trichinosis—Poland—Warsaw.....	127
Trinidad—British West Indies—	
Influenza.....	1505
Quarantine against Martinique—Occurrence of Alastrim.....	1110
Tuberculosis:	
Canada—Decrease in mortality from.....	1501
City reports for week ended—	
December 16, 1922.....	30
December 23, 1922.....	78
December 30, 1922.....	117
January 6, 1923.....	162
January 13, 1923.....	215
January 20, 1923.....	268
January 27, 1923.....	314
February 3, 1923.....	364
February 10, 1923.....	420
February 17, 1923.....	474
February 24, 1923.....	531
March 3, 1923.....	642
March 10, 1923.....	702
March 17, 1923.....	755
March 24, 1923.....	802
March 31, 1923.....	855
April 7, 1923.....	908
April 14, 1923.....	979
April 21, 1923.....	1037
April 28, 1923.....	1100
May 5, 1923.....	1158
May 12, 1923.....	1215
May 19, 1923.....	1285
May 26, 1923.....	1368
June 2, 1923.....	1423
June 9, 1923.....	1494
Index to State laws—Tobey.....	1191
Pneumonia and typhoid fever—Mortality from, in 43 large cities.....	142
Predisposing causes—Smith.....	777
Russia—Ukraine.....	989
The indigent consumptive in cities of the Southwest—Whitney.....	587
Tularæmia—I. X. In the Washington (D. C.) market—Francis.....	1391
Tunis:	
Ben-Gardane—Plague (human).....	1110
Taguelmit—Plague (human)—Pneumonic.....	1433
Turkey—Constantinople:	
Plague (human).....	652
Typhus fever.....	576
Typhoid fever:	
(See also Summaries—Disease cases reported monthly by States.)	
Canada—	
Ontario—Cochrane.....	763, 810, 863
Typhoid fever.....	863
City reports for week ended—	
December 16, 1922.....	29
December 23, 1922.....	78
December 30, 1922.....	116
January 6, 1923.....	160
January 13, 1923.....	214
January 20, 1923.....	267
January 27, 1923.....	314
February 3, 1923.....	364
February 10, 1923.....	420
February 17, 1923.....	474
February 24, 1923.....	531
March 3, 1923.....	641
March 10, 1923.....	701
March 17, 1923.....	754

Typhoid fever—Continued.

City reports for week ended—Continued.

	Page.
March 24, 1923.....	801
March 31, 1923.....	854
April 7, 1923.....	908
April 14, 1923.....	979
April 21, 1923.....	1036
April 28, 1923.....	1100
May 5, 1923.....	1157
May 12, 1923.....	1214
May 19, 1923.....	1285
May 26, 1923.....	1368
June 2, 1923.....	1422
June 9, 1923.....	1493

Compensation for, under workmen's compensation act—Supreme Court decision—Michigan.....	1272
---	------

Jamaica—Kingston and vicinity.....	86,
171, 275, 372, 483, 712, 765, 919, 1047, 1224, 1433	202

Minnesota—Correction.....	202
---------------------------	-----

State morbidity reports—

October, November, December, 1922.....	557
January, February, March, 1923.....	1318

Tuberculosis and pneumonia—Mortality from, in 43 large cities.....	142
--	-----

Union of South Africa—Natal—Frere.....	224
--	-----

Typhus fever:

California—Los Angeles.....	29
-----------------------------	----

Chile—

Antofagasta.....	169
Nitrate regions.....	169
Valparaiso.....	650

City reports for week ended—

December 16, 1922.....	29
December 23, 1922.....	78
January 20, 1923.....	267
May 12, 1923.....	1214
June 9, 1923.....	1493

Connecticut—New Haven.....	267
----------------------------	-----

Danzig (Free City).....	810
-------------------------	-----

Foreign reports—

Cumulative table.....	89,
133, 179, 230, 282, 330, 380, 435, 490, 585, 661, 721, 774, 822, 873,	
930, 999, 1057, 1121, 1123, 1177, 1235, 1342, 1388, 1444, 1515.	

Weekly table.....	37,
88, 131, 175, 226, 278, 326, 375, 430, 485, 578, 655, 715, 767, 815, 866,	
922, 991, 1049, 1112, 1169, 1227, 1333, 1379, 1435, 1506.	

Greece.....	223
-------------	-----

Island of Corfu.....	576
----------------------	-----

Piræus.....	576
-------------	-----

Hungary—Budapest and country districts.....	1502
---	------

Ireland—Belmullet.....	171
------------------------	-----

Latvia—Libau.....	1224
-------------------	------

New York—New York.....	78
------------------------	----

Netherlands—Rotterdam.....	1331
----------------------------	------

Rumania—Bucharest.....	276
------------------------	-----

Russia.....	128
-------------	-----

State morbidity summaries—January, February, March, 1923.....	1324
---	------

Syria—Beirut.....	1167
-------------------	------

Turkey—Constantinople.....	576
----------------------------	-----

Union of South Africa.....	128, 224, 577, 653, 813, 989, 1433
----------------------------	------------------------------------

Vaal River.....	129
-----------------	-----

U.

Undefined disease—Great Britain—Scotland—Glasgow—Probably lethargic encephalitis.....	987
---	-----

Union of South Africa:

Beira—

Influenza.....	577
Lethargic encephalitis.....	577

Union of South Africa—Continued.

Page.

Cape Province—Anthrax.....	652
Cape Town—Vital statistics—June 30, 1921-22.....	713
Natal—Frere—Typhoid fever.....	224
Smallpox.....	128, 224, 813, 989, 1433
Transvaal—	
Klipfontein—Plague (human).....	1377
Molteno district—	
Plague (human).....	653
Plague (rodent).....	653
Typhus fever.....	128, 224, 577, 653, 813, 989, 1433
Vaal River—Typhus fever.....	129
United States:	
Distribution of malaria in, indicated by mortality reports—Maxcy.....	1125
Extent of rural health service—Lumsden.....	885
Increasing virulence of smallpox in.....	1406
Population changes, 1910-1920—Census Monograph No. 1.....	958
Prevalence of influenza.....	63, 141, 199, 250, 345, 403
Quarantine against Gulf ports, by Cuba, suspended.....	85
United States Public Health Service:	
Examinations for entrance into regular corps—Time and places..	202, 252, 301, 349
List of publications issued by.....	1085
U. S. S. <i>Florida</i> —Fish poisoning on board during 1922.....	1405

V.

Vaccination:

Panama Canal—Vaccination of persons arriving from Valparaiso, Chile, ordered.....	373
Requirements to be met by pupils upheld—Court decision—Texas.....	1355
Vaccinia—Effect on leprosy—Hasseltine.....	1

Venereal diseases:

Canada—Ontario.....	36, 169
Control activities—	
Clinic activities and reports of State boards of health from July 1 to December 31, 1922.....	620
Federal allotments to States for cooperative work.....	625
Quarantine for, upheld—Supreme Court decision—Ohio.....	1273
Incidence among American seamen in the Orient—King.....	1477
Russia—Ukraine.....	989

Vermont:

(See also Summaries—Disease cases reported monthly by States.)	
Current State morbidity summaries.....	22,
71, 109, 151, 207, 258, 306, 355, 411, 465, 521, 632, 693, 746, 793, 845, 898, 971, 1029, 1093, 1149, 1206, 1279, 1361, 1414, 1486.	
Schick tests and immunization against diphtheria—Kidder.....	663
Summary of diseases—	
October, November, December, 1922.....	572
January, February, March, 1923.....	1329

Vessels—Fumigation of, from plague infected ports—Grubbs.....	59
---	----

Virgin Islands:

Communicable diseases.....	173, 225, 765, 920, 1225
Poisoning from fish caught in vicinity of—On board U. S. S. <i>Florida</i>	1405

Virginia:

(See also Summaries—Disease cases reported monthly by States.)	
Current State morbidity summaries.....	207, 411, 465, 693, 898, 1029, 1093, 1486
Summary of diseases—	
October, November, December, 1922.....	572
January, February, March, 1923.....	1329
West Point—Changes brought about by the health department—Bagby...	456

Vital statistics:

England and Wales—1921 and 1922.....	683
Lithuania—January-June, 1922.....	1109
Union of South Africa—Cape Town—June 30, 1921-22.....	713
Voegtlin, Carl—Penetration of arsenic into cerebrospinal fluid—Treatment of protozoal infections of central nervous system—Voegtlin, Smith, Dyer, and Thompson.....	1003

W.

Washington:	
(See also Summaries—Disease cases reported monthly by States.)	Page.
Current State morbidity summaries.....	22,
71, 109, 151, 207, 258, 306, 355, 411, 465, 521, 632, 693, 746, 793, 845, 898, 971, 1029, 1093, 1149, 1206, 1278, 1361, 1414, 1486.	
Summary of diseases—	
October, November, December, 1922.....	572
January, February, March, 1923.....	1329
Washington, D. C.—Tularemia in the market—Francis.....	1391
Water:	
Pollution results from lack of cooperation between water board and health officer.....	838
Protecting supplies from phenol wastes—Conference of State health officers with Public Health Service.....	967
Weil's disease—Colombia—Bucaramanga.....	917, 1045
West Indies:	
Barbados—Smallpox (reported as alastrim).....	1045
Domeinica—Alastrim or smallpox.....	174
Island of Guadeloupe—Alastrim.....	174
St. Lucia Island—Smallpox (reported as alastrim).....	1048
West Virginia:	
(See also Summaries—Disease cases reported monthly by States.)	
Current State morbidity summaries.....	22,
71, 109, 151, 207, 258, 306, 355, 411, 465, 521, 632, 693, 746, 793, 845, 898, 971, 1029, 1149, 1207, 1278, 1361, 1414, 1486.	
Huntington—Anthrax.....	356
Summary of diseases—	
October, November, December, 1922.....	572
January, February, March, 1923.....	1329
Whitney, Jassamine S.—Migratory consumptive in cities of the Southwest.....	587
Wisconsin:	
(See also Summaries—Disease cases reported monthly by States.)	
Current State morbidity summaries.....	22,
71, 110, 151, 207, 258, 306, 355, 411, 465, 521, 632, 693, 746, 793, 845, 898, 971, 1029, 1093, 1149, 1207, 1278, 1361, 1414, 1486.	
Summary of diseases—	
October, November, December, 1922.....	573
January, February, March, 1923.....	1329
Wyoming:	
(See also Summaries—Disease cases reported monthly by States.)	
Current State morbidity summaries.....	22,
71, 110, 151, 207, 259, 306, 356, 411, 465, 521, 693, 746, 794, 898, 899, 971, 1093, 1149, 1207, 1278, 1279, 1361, 1414, 1486.	
Summary of diseases—	
September, 1922 (delayed).....	573
October, November, December, 1922.....	573
January, February, March, 1923.....	1329

Y.

Yellow fever:	
Brazil—Bahia.....	428, 650, 710, 763, 809, 862, 1431
Colombia—Bucaramanga.....	1222, 1376
Foreign reports—	
Cumulative table.....	89, 133, 180, 231, 283, 331, 381, 436, 491, 586, 662, 723, 775, 824, 875, 932, 1002, 1060, 1180, 1238, 1345, 1390, 1447, 1518
Weekly table....	37, 376, 430, 655, 715, 767, 816, 866, 922, 1169, 1227, 1379, 1436
Mexico—Tuxtepec.....	811
Yugoslavia:	
Communicable diseases.....	324, 1110
Dysentery.....	325, 1111
Province of Voivodina—	
Communicable diseases.....	324
Dysentery.....	325

ge.
22,
45,

572
329
391

838

967
045

045
174
174
048

22,
845,

356

572
1329
587

22,
898,

573
1329

22,
971,

573
573
1329

, 1431
, 1376

, 586,
, 1518
, 1436
811

, 1110
, 1111

324
325